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CALIFORNIA DAIRY FARM MANAGEMENT

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CALIFORNIA is in a healthy condition so far as dairy products are concerned. It is a deficit area with more dairy products shipped in than are shipped out; and its dairies have a high production efficiency, partly because of abundant high-quality dairy feed. Nevertheless, a dairy farm in California is an intensive enterprise, existing on high-priced land and given over exclusively to dairy farming. As in all intensive farming, the capital investment is high, and the operating costs can become very high unless good management practices are applied consistently.

THIS CIRCULAR, which is concerned with protit-determining factors, describes the good management practices involved in each. The records are from many successful dairies throughout the state. Since feeding practices are the most important items in both production and expense, how to get the best feeding program at the lowest possible cost is considered in detail. This information is of value to the established dairyman and the sometime dairyman as well.

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DAIRY FARM MANAGEMENT

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DAIRYING AS A BUSINESS . . .

is an important enterprise in the state of California

DAIRYING, in value of its products, is one of the most important single agricultural enterprises in California, and the most widely distributed over the state. In 1949, milk was the major source of income for about 13,000 farms. In 1951, the California Crop and Livestock Reporting Service estimated an average of 781,000 cows milked (table 1). These produced 6,014 million pounds of milk. Cash received from sale of dairy products in 1951 was $280,526,000, or 11 per cent of the total value of farm products sold. Dairymen, in maintaining their herds, also produced and sold a substantial value of cattle and calves. Cows and surplus calves from dairy herds contributed a considerable portion of the state's supply of beef and veal.

TWO TYPES OF MILK

Milk from California farms is sold as market milk or as manufacturing milk. The proportion of market milk, which has been increasing steadily in recent years, passed the 50 per cent mark in 1943 and was about 67 per cent of the total in 1951.

Market milk. Milk produced and sold under the strict sanitary requirements of state and city laws and regulations for fluid milk and cream is called market milk or grade-A milk. It brings a higher price than manufacturing milk, but requires better buildings and more equipment for cooling and handling. A dairy so equipped, and selling the major part of its milk for this purpose is called a market-milk or grade-A dairy.

Minimum prices of fluid milk to producer, and of market milk and cream to wholesaler and consumer, are determined according to state law by the Bureau of Milk Control of the State Department of Agriculture in thirty-four marketing areas covering most of the state. The average milk-fat content of market milk was 3.86 per cent for the state as a whole in 1950. Payment in most areas is for 100 pounds of milk according to a schedule for varying fat content.

Manufacturing milk. All milk other than market milk is called manufacturing milk. In California most of it is now sold as whole milk for the manufacture of evaporated milk, dried milk, cheese, and

Table 1: CALIFORNIA DAIRY COWS, PRODUCTION, AND VALUE OF MILK

Period or year	Cows milked, average for year	Average production per cow		Commercial milk-fat production			Market milk	Average price per hundredweight		Cash farm income from milk, excluding subsidies
		Milk	Fat	Total	Market milk	Manufacturing milk		Market milk	Manufacturing milk	
	thousands	pounds	pounds	million pounds	million pounds	million pounds	per cent	dollars	dollars	thousand dollars
Prewar 1937–1941	687	6,796	260	166.4	74.8	91.6	45	2.30	1.64	92,615
War–4 yr., 1942–1945	772	7,000	270	191.2	105.3	85.9	55	3.90	3.38	175,558
Postwar, 1946–1950	798	7,390	288	216.6	136.5	80.1	63	4.71	3.64	254,283
1946	825	7,110	274	212.3	128.6	83.7	61	4.41	3.82	242,309
1947	824	7,250	283	219.3	136.3	83.0	62	4.85	3.70	263,096
1948	786	7,360	287	213.6	135.3	78.3	63	5.18	4.25	278,744
1949	780	7,520	293	216.8	139.5	77.3	64	4.77	3.23	250,225
1950	777	7,710	301	220.9	142.8	78.0	65	4.34	3.19	237,042
1951	781	7,700	300	221.5	149.5	72.0	67	4.35	3.98	280,526

butter. A small amount of farm-separated churning cream is still sold in this state (around 3 per cent of the total manufacturing milk fat) and it is included in manufacturing milk.

Manufacturing milk is largely paid for on a milk-fat basis, or at separate prices for the milk fat and the skim milk. Since prices of manufactured dairy products are determined largely by supply and demand conditions for the country as a whole, the California manufacturing-milk producer competes with dairymen all over the country. Although manufacturing-milk production and number of creameries are declining in California, the manufacturing-milk producer can still find one or more outlets for his milk in most of the state.

SPECIALIZED DAIRY FARMS

Commerical production of either main type of milk in California is mostly on specialized dairy farms that produce little else than all or part of the roughage used by the dairy herd. The average-sized herd is larger than in any other important dairy state. From the 1950 census and other data currently available, there are an estimated 18,000 farms in California on which dairying is important. Allowing for family cows, there is an average of around 40 cows per commercial dairy. These account for 90 per cent of the dairy cows in the state and 95 per cent of the total milk-fat production. In a number of leading market-milk counties, such as Los Angeles, Orange, San Diego, Santa Clara, and Marin, the average-sized dairy herd is more than 100 cows. No other state shows such a high concentration of dairy cows in large commerical dairies.

Even where a dairy enterprise is associated with other enterprises on a general farm or a fruit farm, it is usually fairly large and handled by special help. Most of the cows milked are dairy breeds. Little commerical milk is produced in dual-purpose or beef herds.

OTHER TYPES OF DAIRY FARMS

Despite the highly specialized nature of dairying in California, there are many types of dairy farms. The wide distribution of dairying over the state in areas of different climates, kinds of feed, and cost levels, makes for these variations.

In high-cost areas around metropolitan centers only market-milk dairies are found. Some of these are corral or dry-lot dairies where no feed is produced and few calves are raised. Farther out in the country are dairy farms where part or all of the forage is grown on the farm as pasture, hay, and silage. Both manufacturing-milk and market-milk dairies are in some major dairy regions. In the most distant areas, market-milk production is largely limited to local needs, and manufacturing-milk dairies predominate.

PRODUCTION EFFICIENCY

Production efficiency for California dairies is the highest for any state in the union. Average production per cow in 1950 was 7,710 pounds of milk and 301 pounds of milk fat per cow as compared with 5,292 pounds of milk and 211 pounds of milk fat per cow for the United States.

California in January, 1952, was the highest dairy state in number and per cent of cows on test, with 23 per cent tested for production by dairy herd improvement associations, compared with 5 per cent for the entire country. Average production per cow for California cows on test was 415 pounds of milk fat, compared with 370 for all cows on test in the country in 1950. High production per cow may be attributed in part to the abundant high-quality dairy feed, but more largely to good management.

THE PRESENT SITUATION

California is a deficit area for dairy products; more are shipped in than are shipped out. While the state produces practically all of its market milk and cream, and more evaporated milk and

dried milk than it consumes, it now ships in from other states most of its butter and cheese. The state also is deficit in the production of cows to maintain its milking herds. Approximately 40,000 dairy cows were shipped in from other states in 1950, or 5 per cent of the total.

Consumption of market milk and other dairy products has been increasing rapidly with California's increasing population, high consumer-buying power, and development of consumer preferences for dairy products. But the number of cows and the amount of milk produced, although increasing, have not kept pace with increasing demand.

THE FUTURE

It seems unlikely that dairy production in California will ever increase enough to reverse the status of the state from a deficit to a surplus dairy-products area. Population is expected to continue to increase in this state at a faster rate than in the United States as a whole. It is doubtful whether there will be enough increase in dairy cows and production to keep up with increasing demand. Much will depend on the profit possibilities from alternative uses of land, water, and labor.

PRICE OUTLOOK PREDICTS FUTURE

Milk and feed prices change from time to time. The dairyman should watch the price outlook for opportunities to improve profits or for warnings of more difficult times. Although he cannot jump in or out of business with changes in prices and profits, he can, by basing his policy decisions on the current situation and outlook, improve his chances of success and security.

When concentrates and hay are at seasonal low prices, it is a good time to buy the year's feed requirement. When cow prices are high, it is a good time to sell cull and surplus cows. When the outlook for earnings is poor, it is important to economize on both business and personal expenditures and keep the budget balanced to remain financially strong.

To employ good management practices all the time is the dairyman's safeguard in bad times, and his assurance of higher profits in good times.

CALIFORNIA'S SIX DAIRY REGIONS . . .

extend nearly the entire length and breadth of the state

The state is divided into six major dairy regions. Their commercial milk-fat production is shown in figure 1. Number of dairy farms, cows, and the amount of production are given in table 2.

NORTH COAST

Dairying here is largely the production of manufacturing milk from the hay, pasture, silage, and root crops in coastal valleys and along the coastal bench. Rainfall is higher than in any other part of the state, beginning earlier in the fall and extending later into the spring, so that natural pasture and hay meadows are very productive. Winters, although mild, are so wet that many fields cannot be pastured. It is usual, therefore, to freshen most of the cows in the spring, making a highly seasonal production. The practice of irrigating is increasing. This prolongs the green-feed season through late summer and early fall. Most of the hay and some silage are produced in this area, although additional hay is now purchased from outside areas.

No substantial increase or decrease in dairying in this region has taken place in recent years or is expected in the future. The arable land is already fully

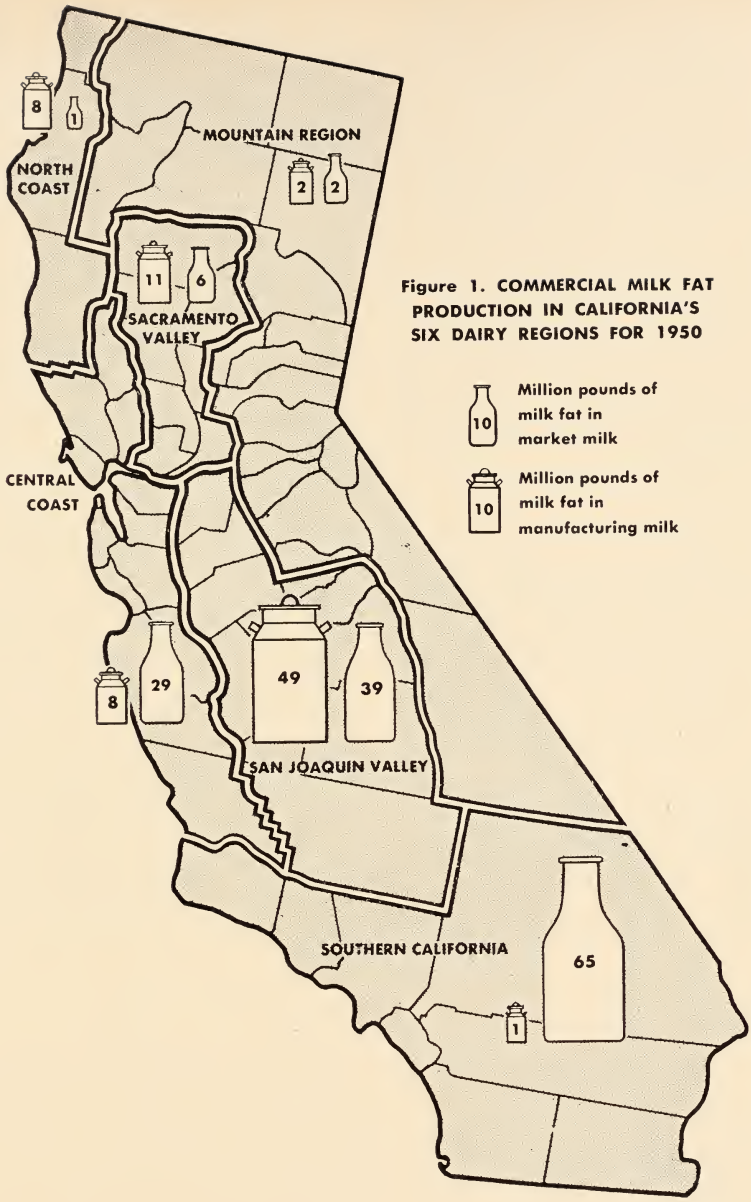

Figure 1. COMMERCIAL MILK FAT PRODUCTION IN CALIFORNIA'S SIX DAIRY REGIONS FOR 1950

developed and, although there may be some shifts of land in and out of dairying, intensification through increased irrigation will be the principal development. No early shift from manufacturing milk to market milk for shipment to San Francisco from the Humboldt-Del Norte area is expected because distance and mountainous terrain make transportation expensive.

CENTRAL COAST

This long region extends from Sonoma and Lake counties on the north to San Luis Obispo County on the south. The region also includes a few counties away from the coast and, hence, has a range from coastal through semicoastal to interior climatic conditions. Several large, partially irrigated valleys have conditions similar to Central Valley areas.

Table 2: DAIRY FARMS, COWS, AND PRODUCTION BY REGIONS

	North Coast	Central Coast	Southern California	Sacramento Valley	San Joaquin Valley	Mountain	California total
From 1950 Census of Agriculture:							
Dairy farms	816	1,678	1,167	1,609	7,244	455	12,969
Per cent above farms of all farms	21	6	3	10	18	5	9
Dairy products sold, $1,000	7,589	38,059	81,535	14,853	73,832	3,668	219,536
Per cent dairy products of total	39	13	15	8	11	7	13
Milk cows	34,124	129,572	167,054	68,734	290,993	24,371	714,848
From California Crop and Livestock Reporting Service for 1950:							
Dairy cows, 2 yr. and over, January 1	42,000	162,000	232,500	84,500	353,500	28,500	903,000
Commercial production of milk fat:							
Market milk, 1,000 pounds	1,246	29,358	65,520	5,983	38,784	1,883	142,774
Manufacturing milk, 1,000 pounds	8,193	7,945	760	10,756	48,672	1,762	78,088
Total milk fat, 1950, 1,000 pounds	9,439	37,303	66,280	16,739	87,456	3,645	220,862
Per cent market milk	13	79	99	36	44	52	65

Seasonality by region and type of product, 1950

Per cent of monthly average

	North Coast		Central Coast		Southern California		Sacramento Valley		San Joaquin Valley		Mountain		California total	
	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk
January	89	28	106	98	102	63	98	76	96	85	100	76	101	79
February	83	29	95	104	92	79	86	73	88	80	85	74	91	76
March	99	89	108	132	102	145	102	102	102	100	99	95	103	103
April	96	141	105	141	99	115	104	118	103	108	104	114	101	116
May	102	169	106	141	102	207	108	130	107	118	113	144	105	129
June	102	159	95	119	99	145	104	126	104	117	106	126	100	123
July	106	148	96	94	100	137	103	121	104	119	102	127	101	120
August	113	126	97	83	101	68	102	114	103	114	105	114	101	111
September	109	105	95	68	99	58	100	98	97	100	100	98	98	97
October	108	92	100	70	102	51	101	88	101	93	94	87	101	89
November	99	71	95	68	99	57	96	79	96	83	94	74	97	79
December	94	46	101	84	105	74	97	74	98	84	98	70	102	78

It is an old and well-developed dairy region but with many shifts and changes in its various parts. Its production is now predominantly market milk for the San Francisco Bay area and other large centers of population. Dairying in some counties has increased while in others it has declined, with a net increase over the last ten years for the region as a whole, although there has been a small decline since 1947.

SOUTHERN CALIFORNIA

Dairying here is almost entirely the production of market milk for the large local population. In this area of low rainfall most crop production depends on irrigation. Land values are high because of high-value fruit and truck crops and pressure of population. Irrigation water is limited and costly. There is some use of temporary crop residue and irrigated pastures even in congested high-cost areas.

Near Los Angeles, dairying consists of the corral feeding of cows with purchased hay and concentrates shipped in from distant producing areas. These corral or dry-lot dairies around Los Angeles are unique. They might be called milk factories rather than farms. Few replacements are raised in the congested area, and herds are maintained by shipment of cows from other areas. Yet, Los Angeles County is the leading dairy county in the state and nation. Production per cow is the highest anywhere. This great dairy development under almost urban conditions is accounted for by the large consuming market, isolated by mountains and desert from distant areas perhaps better adapted to dairying.

In Riverside, San Bernardino, and San Diego counties, away from the congested area, there are more farm-grown forage crops and irrigated pastures. The use of irrigated pasture has increased in recent years, but its use will always be more limited than in the Central Valley areas of the state.

Imperial County, in the southeast corner of the state, has some dairying on irrigated land under hot, dry conditions. Some years ago this area produced considerable manufacturing milk, with alfalfa as pasture and hay the main feed. Alfalfa was used in rotation with high-value crops, and dairymen rotated somewhat from farm to farm to utilize the alfalfa. In recent years dairying has declined, and about 70 per cent of the present production is market milk for local use and for shipment to San Diego. In the prevailing high summer temperatures, cows produce somewhat less than in more comfortable climates. With low-cost, efficient forage production, greater use of shelters and cooling devices, and wider use of a system of seasonal production, dairying could be efficient and economical. It may increase again if alternative uses of land become less profitable.

MOUNTAIN REGION

This region is large geographically but not important agriculturally, since most of it is mountainous and not adapted to farming. Aside from some market-milk production for local use there is little dairying except in the few northern and eastern counties that join and extend down to the Sacramento Valley. Dairying has been declining in importance in most of the more distant mountain valleys with some shifting to beef cattle. There is some churning-cream production as a sideline on beef cattle ranches, and this could increase again if beef cattle prices should decline materially at any time in the future.

Dairying in this part of the state is based largely on hay and a combination of irrigated and natural pasture. Winters here are longer and more severe and necessitate a greater use of hay than in other regions. The mountain region is an area in which it is possible to raise dairy stock cheaply on the range with beef cattle.

SAN JOAQUIN VALLEY

The San Joaquin Valley is the most important dairy region in the state and contains about 40 per cent of the cows. Production here has increased more than 25 per cent in the last ten years, and the proportion of market milk produced has increased to 44 per cent. In addition to supplying market milk for its local population, a large amount is shipped to the Los Angeles and San Francisco areas. Additional shifting to market milk will take place as demand increases.

Dairying in this area is based largely on alfalfa hay and irrigated pasture. Since it is a large commercial-milk, plus alfalfa-hay-producing area, the local farm value or cost of hay is below the cost to dairymen near San Francisco and Los Angeles. There is also considerable local grain production. Irrigation water for the region as a whole is more plentiful and lower in cost than in southern California, and irrigated pasture provides economical dairy feed. Alfalfa is also a preferred crop here, in rotation with cotton, potatoes, and truck crops.

It is the usual practice in this valley, in both types of dairies, to maintain or increase the herds through raising heifers within the enterprise. There is always some buying and selling, and some of the enterprises raise surplus heifers and even a few bull calves for sale.

Dairying may be expected to increase in the San Joaquin Valley. As a result of the Central Valley Project, there should be some additional water, and, therefore, more irrigated pasture and alfalfa. Much of the additional market milk required by the larger future population in California can come from this area. Cotton farming was highly competitive with dairying in 1951 and 1952, with some dairymen shifting to cotton. But the decline in milk production for the area was small from 1950 to 1951.

SACRAMENTO VALLEY

Milk production is increasing in this part of the state. A considerable part of the land here, yet to be irrigated, is better adapted to irrigated pasture than to higher-value fruit, truck, and field crops, so dairying will continue to increase. Although still mainly a manufacturing-milk region, market milk was 36 per cent of the total in 1950 and will continue to increase. Dairying is largely based on irrigated pasture, alfalfa hay, oats, and vetch hay. This area is similar to the San Joaquin Valley, which joins it on the south, but has a narrower range of adapted, competing crops.

WHAT CONSTITUTES THE DAIRY ENTERPRISE?

The dairy herd is the enterprise; feed growing is a separate business

The dairy enterprise is composed of the dairy herd, which includes the milking cows, dry cows, bulls, heifers, and calves. Its size is expressed in average number of cows, both dry and milking, for the year. Bulls, heifers, and calves are included as additional animal units.

An animal unit is the mature head or equivalent in feed requirement. Animal units per head for dairy cattle are as follows: cows and bulls, 1; calves under 3 months, .25; calves 3 months to 1 year, .40; heifers 1 to 2 years, .70; and heifers from 2 years to first calving, .75. The animal units per cow, in herds where replacements are being raised, average around 1.4 (can be as low as 1.35) the 1 being the cow itself, and .4 being the proportion of additional stock in bulls, calves, and heifers.

Feed growing is actually in separate enterprises. The consideration of the feed

enterprises apart from the dairy enterprise is an aid to good management. A farm with a poorly managed dairy enterprise might even be fairly profitable if accompanied by efficient, economical feed-producing enterprises. On the other hand, higher profits from the farm as a whole might come from expanding the dairy and pasture enterprises and eliminating an unprofitable hay enterprise.

Income from the dairy enterprise is mainly from milk sold. Manure may be sold or credited to the dairy when used on other enterprises. Some stock usually is sold. In dairy enterprise records, stock purchases are deducted from stock sales and the difference is shown as a net stock income. Where replacements are raised in the herd there is usually a net stock income. Where they are purchased and calves are not raised, there is a net stock cost.

Costs in the dairy enterprise are for feed, labor, miscellaneous items, depreciation on dairy buildings and equipment, and interest on the capital invested in the dairy enterprise. Purchased feed is charged to the dairy enterprise at cost. Farm-grown feed is charged by quantity at its local current farm value, which is market value less cost of marketing.

Earnings are shown in dairy enterprise studies in two different ways. *Management income* is the amount by which total income exceeds total costs of production, including as costs the value of the operator's own labor and interest on the capital invested. *Farm income* is the amount the operator makes from his enterprise through management, labor, and invested capital.

The costs, returns, and earnings shown apply only to the dairy enterprise, which is usually only a part of the dairy-farm business. Feed and other crop-production enterprises have additional costs, returns, and profits or losses. Table 5 shows income, costs, and earnings for market- and manufacturing-milk dairies in the San Joaquin Valley for 1947 and 1948.

THE PROFIT FORMULA . . .

There are four profit-determining factors in the formula

This formula is defined as:

Profit = Production per cow x price of milk fat per pound + net stock income – expense per cow. The four profit-determining factors in the formula are:

1. Production per cow
2. Price of milk fat per pound
3. Net stock income per cow
4. Total expense per cow

None of these factors stands alone; all are interrelated.

PRODUCTION PER COW

Higher production per average cow in the herd tends to increase profit. There are three main factors in increasing average production per cow: feeding, culling, and breeding.

FEEDING AND PRODUCTION

Each cow has a definite hereditary maximum production capacity. The extent to which her production reaches this capacity is determined by the quantity and quality of the feed received. It is profitable to feed each cow so that she can approach the highest production of which she is capable. But the use of additional feed would be wasteful, in that it would result in accumulating unnecessary body fat that would further increase the feed required for maintenance. The use of more expensive kinds of feed than are necessary also is a waste of money.

Adequate and yet economical feeding of each dairy cow in his herd is probably the dairyman's greatest managerial prob-

lem. Its satisfactory solution is lacking in most unprofitable dairy enterprises.

The subject of feeding and costs is discussed on pages 23 to 30 under "Getting Maximum Return from Feed Costs."

CULLING AND PRODUCTION

The removal of low-producing cows from a herd increases the average production of the remaining herd. This is called culling for production, since there may be other reasons for culling, such as disease.

The testing of cows for production is prerequisite to intelligent culling for production and to maintaining a high herd average production per cow. Dairy herd improvement associations provide this testing service in all leading dairy counties in California at costs of about 30 cents per cow per month. Knowing each cow's production enables the dairyman gradually to eliminate poor ones and replace with better ones, and to feed according to production.

It is difficult to give any definite production level at which a cow is a cull and should be eliminated. A general rule is: any cow whose annual production does not pay direct feed and labor costs, and whose disposal would not reduce income more than it reduces costs, should be disposed of at once. Cows that are earning a small profit and for a which a better replacement is not available should be kept until the space or feed is needed for a better cow or more promising heifer. A cow giving 200 pounds of fat might not be a cull on some dairy farms, while one giving 400 pounds might be a cull in a high-producing herd if space were needed for a cow with a potentiality of 500 pounds of milk fat.

Culling must be practical and gradual, since it is important to maintain the herd at a size that best fits available feed, labor, and buildings and equipment. It can be used as a means of keeping herd size at its best number through removal of poor animals as better ones become available.

BREEDING AND PRODUCTION

Dairy cattle inherit the capacity to attain high production. The best way to provide replacement heifers of high producing ability is to breed high-producing cows to bulls able to transmit high production. The breeding program and the culling program work together to produce a good herd.

One object of the breeding program is to obtain regularity and proper length of lactation periods by getting the cow with calf at the proper time. Having each cow in production from 10 to 11 months of the year will result in highest average production per cow. Cows are in milk about 83 per cent of the time in most regions in California, which is equivalent to 10 months of the year. Breeding trouble or carelessness can reduce this to 60 per cent, with corresponding loss of production and income. A breeding record of individual cows and control of breeding through confinement of bulls are essential to regularity in the breeding program.

A second object of the breeding program is to have cows in milk at the right time of the year. Whether to have cows in milk to take advantage of natural feed or to stabilize production through the year, or to obtain maximum production for the year, is a decision that only the individual dairyman can make.

Fall freshening is known to result in higher total production for the year than spring freshening. The cooler weather at freshening, the tendency toward high production the first few months to carry through the winter, and good, natural spring pasture stimulating and prolonging production, combine for higher total production from cows freshening in the fall. Seasonality of production is discussed under price of milk fat.

PRICE OF MILK FAT

The dairyman can exert a little influence on price through type of milk produced, its quality, the seasonal production

of milk during the year, and selection of a marketing agency.

TYPE AND PRICE

Market milk usually brings enough more than manufacturing milk to cover the additional costs of production and to allow for some increased profit. Whole milk for manufacturing purposes usually brings more than churning cream plus skim milk. (There may be localities, however, where transportation difficulties make it necessary to sell churning cream and to use the skim milk for other stock on the farm.)

QUALITY AND PRICE

Before the war there were some opportunities for sale of premium milk of high color and fat content. During the war, premium milk was discontinued but it is again available, with consumption increasing to 5 per cent of total whole milk sales by November, 1951. Clean milk of good flavor is essential to selling market milk.

SEASONALITY AND PRICE

For every region and every type of product there is a seasonal-production pattern that best fits local feed and marketing conditions and results in greatest profit.

The market-milk producer needs even production through the year. He can improve his average price by adjusting level of production through the year to market demand, and avoiding a seasonal surplus to be sold at the lower manufacturing-milk price.

Prices of manufacturing-milk, determined more by national than by local supply and demand, are usually higher in the fall and winter than in the spring. By freshening more of his cows in the fall, the dairyman can get a larger proportion of his production in the fall and winter months. This, plus the fact that fall-freshened cows give more milk and more milk-fat, will make fall-freshening profitable. Where bad winters are not a handicap, and irrigated pasture is available for late summer and fall feed, as in the valley regions, fall freshening could increase profit by several dollars a cow.

There are feeding problems associated with seasonal production which the dairyman must consider when determining the most profitable policy for his farm. Fresh, high-producing cows require almost twice as much feed as dry cows. If spring produces a high surplus peak of natural pasture, that is the time to have the herd milking heavily. Some market-milk producers may find it profitable to have a spring surplus even though this excess production over a base quota brings the manufacturing-milk price. This is an individual problem requiring careful analysis.

An example of herd management to obtain the desired seasonality of production is given in table 3, for market-milk dairies and manufacturing-milk dairies in Sonoma and Marin counties. Notice that the market-milk dairies had rather even production through the year with freshenings also rather evenly distributed through the year. The manufacturing-milk producers had the highest number of cows, fewest dry cows, and highest production from March through June to take maximum advantage of good natural pasture.

NET STOCK INCOME

Most dairy enterprises include the raising and selling of some dairy stock. The consideration of how many and what kinds of animals should make up the herd, which animals are to be raised for use in the herd, which calves should be sold or destroyed at birth and which should be raised before selling—all constitute an essential part of dairy farm management. Over the years, enterprise records show higher profits associated usually with higher net stock income.

In some herds only enough heifer calves are raised for replacements. In others, most heifer calves and perhaps

Table 3: COWS IN HERD AND PRODUCTION BY MONTHS, SONOMA AND MARIN COUNTIES, 1947

	21 market-milk dairies						6 manufacturing-milk dairies					
	Cows first of month			Total freshenings	Pounds fat per cow in herd	Per cent of year's total	Cows first of month			Total freshenings	Pounds fat per cow in herd	Per cent of year's total
	Milking	Dry	Total				Milking	Dry	Total			
	No. per 100 cow-years						No. per 100 cow-years					
January	79.2	19.4	98.6	9.0	29.1	8.2	72.7	21.7	94.4	14.1	26.2	8.8
February	80.4	19.3	99.7	7.8	27.2	7.7	85.8	14.1	99.9	14.6	27.1	9.7
March	81.9	17.8	99.7	6.9	32.5	9.2	95.6	8.8	104.4	9.8	33.9	12.6
April	82.7	16.9	99.6	7.2	32.7	9.3	102.2	2.0	104.2	1.8	34.8	13.0
May	84.1	16.2	100.3	8.1	32.1	9.2	102.7	1.7	104.4	1.5	33.7	12.6
June	85.1	15.5	100.6	6.5	29.0	8.3	103.2	0.8	104.0	0.0	27.2	10.1
July	84.5	14.8	99.3	5.1	29.1	8.2	97.9	4.8	102.7	0.0	19.2	7.0
August	83.7	15.3	99.0	7.7	28.6	8.1	61.9	37.5	99.4	3.5	12.8	4.5
September	84.0	15.5	99.5	7.8	27.0	7.6	41.0	57.2	98.2	8.6	10.6	3.7
October	81.6	18.1	99.7	10.8	27.8	7.9	44.3	54.4	98.7	10.1	14.5	5.1
November	82.9	18.8	101.7	9.1	27.9	8.1	47.8	47.1	94.9	11.6	19.9	6.8
December	83.0	19.2	102.2	8.4	28.3	8.2	52.3	42.3	94.6	18.6	18.0	6.1
Average or total	82.8	17.2	100.0	94.4	351.3	100.0	75.6	24.4	100.0	94.2	280.0	100.0

Source of data: Supplemental records obtained by Agricultural Extension Service in connection with cost survey by State Department of Agriculture.

Net Stock Income = total sales of dairy stock – total purchases of dairy stock
+ increase
or
– decrease
} in stock on hand as shown by annual inventory.

some bull and veal calves are raised for sale or for use in the herd. Purebred or registered animals may be raised to take advantage of prices substantially above those paid for grade stock. In most herds occasional purchase of outside stock is necessary in the breeding and replacement program. But sales of stock usually exceed purchases and result in a *net stock income.*

Net stock income is the value of stock produced over the cost of stock bought and the death losses and decline in value of stock in the herd. The formula for net stock income may be stated as above.

Net stock income is not a profit from raising dairy stock since costs of production are not considered and would be difficult to segregate from costs of milk production. Where replacements are purchased and no stock is raised in the enterprise, as in some corral dairies around Los Angeles, purchases exceed sales, leaving a net stock cost instead of a net stock income.

To make the most of this factor of Net Stock Income the dairyman must consider each animal, its usefulness in the herd, and when and how to dispose of it. The kinds of animals he considers are: heifers for replacements; bulls; bull calves for veal; stock for beef; and purebred stock. There are advantages and disadvantages to owning and raising each kind of animal. The most important of these are discussed below.

HEIFERS FOR REPLACEMENTS

The maintenance of a herd of milking cows with satisfactory production requires the replacement of about one out of five, or 20 per cent, of the average number of cows each year. Death losses average about 2 per cent and culling for production and disease will remove the other 18 per cent. The figures vary widely from year to year and from herd to herd, but these figures are a rough guide to replacement needs. Corral dairies in southern California, where replacements are purchased as cows, have a much higher replacement requirement, usually from 30 to 50 per cent.

By this method, cost for each replacement is the difference between cost of the replacement cow delivered to the ranch, and the sale value, usually for beef, of the cull cow being replaced. Where calves are raised, the costs of replacement are included in feed and other enterprise costs.

The cost of raising dairy heifers varies widely with different feed used, feed prices, time required, and bull service chargeable to the heifers.

For a manufacturing-milk dairy farm in a region of low hay and pasture costs, dependent largely on natural pasture, the estimated cost of a two-year-old bred heifer is about $160. An additional 6 months before calving would add $40 to her cost.

On a market-milk dairy, under probable higher cost conditions and on irrigated pasture, the estimated cost of the two-year bred heifer is about $190. Another six months before calving would add $55 to these costs. It is an economy to feed heifers well for maturity and freshening at two to two and one-half years of age.

BULLS

The bull has two functions in the herd: 1) to breed the cows for calves and milk; and 2) to produce superior heifer calves to maintain or increase average production per cow.

The cost of service from an owned bull is usually an unsegregated part of dairy enterprise expenses. Cost is composed of two parts: 1) maintenance, including feeding, housing, and care of the bull; and 2) ownership, including depreciation and interest on the investment.

In corral dairies, where no calves are saved, any potent bull is satisfactory, and his costs are chiefly for maintenance. Ownership costs are low because a cheap bull is purchased usually at beef prices, and later sold for beef with little depreciation. In dairies where heifer calves are raised for replacement or sale, a good bull is essential and his initial cost is considerably more than his ultimate salvage value as beef.

Dairy bulls are kept in individual pens and, although they may occasionally receive a little pasture, they are fed largely hay. One dairy bull in a year would probably require 5 tons of hay, 500 pounds of concentrates, and about 40 hours of labor for feeding, cleaning the pen, and other tasks. At $20 a ton for hay, $3 per cwt for concentrates, and $1 an hour for labor, these costs would total $155. To this may be added about $10 for miscellaneous costs and $25 for housing. This brings the annual maintenance cost of the bull to just under $200. Dairy enterprise records show an average of one bull to about 20 cows, so bull maintenance for 20 cows costs about $10 per cow. This is the part of cost considered as chargeable to milk production.

Ownership costs may vary widely with purchase and selling price of bulls. A $500 bull sold three years later for beef for $250 would show an annual depreciation of $83 a year; and interest of $18 on the average investment would bring total ownership cost to $100 a year. If bred to 20 cows annually, with about 10 heifer calves obtained, of which eight might be worth raising, the bull charge against the heifer calves would be about $12 a piece.

Combining the two costs and functions gives an annual cost of $250 to $300 a year per bull. This amounts to a service cost of from $12.50 to $15 a cow for 20 cows served and $8 to $10 for 30 cows.

These costs indicate the economy of obtaining artificial insemination where available at a reasonable cost and in a satisfactory manner. Better and more expensive bulls can be used for artificial breeding and still result in a lower cost per cow than under individual ownership, since more cows can be served. The average number of cows bred per bull in all artificial breeding associations in the United States in 1950 was 1,223. One association averaged 3,916 cows per bull. A dairyman can well afford to pay more for service from an outstanding bull that has proved his ability to transmit high production. Artificial breeding with semen from bulls that have been proved to increase production in daughters over their dams is now available in most dairy areas in California. Fees vary around $8 per cow.

The cost of raising a heifer is so great that an additional $10 or $15 invested in better breeding will be well repaid by the additional profit from higher production over several years. This system of breeding cows is successful and sound and has been increasing rapidly in California. About 10 per cent of the dairy cows in the state, bred in 1951, are estimated to have been bred artificially.

BULL CALVES FOR VEAL

Prior to World War II, very few dairy calves were raised for veal in California manufacturing-milk dairy enterprises and none in market-milk dairies. Recent high veal prices, however, have resulted in the raising of most bull calves either by the dairyman or by some one else. True veal is produced mainly on whole milk, without supplement of grain or hay, at a requirement of 10 pounds to a pound of gain in a young calf. Whole milk usually appears too valuable to justify its use in meat production.

Ordinarily, only calves with high birth weight justify this high cost of feeding, and then only when the price of milk is low compared with the price of veal. A 90-pound calf requires 600 pounds of whole milk over 6 to 8 weeks to reach a good, marketable weight of 150 pounds. With milk worth $4 cwt, the value of the milk used would be $24. To cover labor and other costs, a veal calf should bring more than this to pay for feed cost—perhaps 25 cents a pound or $38 a head.

Of course there may be times on manufacturing-milk dairies when milk is low in price that it would pay to raise some of the bull calves, perhaps with nurse cows. Also, the dairyman who sells his milk wholesale and buys his meat retail may well produce enough veal and beef from his own calves for home use.

STOCK FOR BEEF

It rarely pays for dairymen to raise calves for beef. Facilities and feeds on the dairy farm are usually more limited and costly than those used in beef production. They are more profitable when used exclusively for milk production plus the raising of some dairy stock for breeding and replacement purposes. Only where the dairy enterprise is not large enough to utilize the available pasture would it pay to raise a few of the best calves for beef. Holstein steers have been observed to make good gains rather economically on irrigated pasture.

PUREBRED STOCK

The raising and selling of purebred stock is not often as profitable as it would appear to the outsider. Most of the few available enterprise management study records on such herds show little or no greater earnings per cow than in grade herds. Milk is still the major part of the income on such farms, and production must be higher than in grade commercial herds to justify the breeding and registration program and to cover its higher costs.

A survey of individual cows on test in 1941 showed that purebred cows averaged 40 pounds more of fat per cow than grades. Dairymen with good high-producing herds including a few registered cows do have an opportunity to do some constructive breeding. They may have the satisfaction of producing at a good profit some outstanding animals of high value.

WHAT STOCK SALES MAY BE EXPECTED?

Dairy stock raised and sold varies widely from herd to herd and from year to year. Where most of the replacements are raised in the herd and a few additional animals are raised for sale or to increase the size of the herd, the net stock income will vary from 5 to 20 per cent of the total income of the dairy enterprise and will average around 10 per cent over the years under varying price conditions.

In Holstein herds, where replacements are raised and where cull cows weigh 1,200 pounds, the net stock income will be equivalent to the value of 300 pounds of the cows sold—about $48 a cow when cutter and canner cows bring 16 cents a pound. The raising of additional stock will increase this amount. With lighter breeds having cows of 900 pounds, net stock income will be equivalent to 220 pounds of cull cow value. Variation in prices of beef and the value of dropped calves that can be raised for veal cause variation in net stock income from year to year.

Averages of dairy records for two areas in matters of stock raised and sold and computation of net stock income are shown in table 4. The 169 San Joaquin Valley records over the four years, 1947–1950 appear in the left-hand section of the table. In these dairies, Holsteins were in the majority and there were a number of purebred herds selling high-value breeding animals so the average net stock income was high at $71.11 per cow. There

Table 4: HERD COMPOSITION AND NET STOCK INCOME IN TWO AREAS*

	Animal units per head	169 San Joaquin Valley records, 1947–1950				33 Humboldt County records, 1949–1950			
		Head	Animal units	Died	Sold	Head	Animal units	Died	Sold
		Average number per average cow for the year							
Bulls	1.00	.04	.04	n.a.†	n.a.†	.04	.04	n.a.†	n.a.†
Cows	1.00	1.00	1.00	.02	.25	1.00	1.00	.01	.19
Calves under 3 mo.	.25	.17	.04	n.a.	n.a.	.08	.02	n.a.	n.a.
Calves 3 mo. to 1 yr.	.40	.28	.11	n.a.	n.a.	.23	.09	n.a.	n.a.
Heifers 1 to 2 yr.	.70	.30	.21	n.a.	n.a.	.22	.15	n.a.	n.a.
Heifers over 2 yr.	.75	.14	.11	n.a.	n.a.	.03	.02	n.a.	n.a.
Total		1.93	1.51	n.a.	.65	1.60	1.32	n.a.	.64

	No. head per cow	Av. price per head	Value per av. cow	No. head per cow	Av. price per head	Value per av. cow
Cows sold	.25	$182.36	$45.01	.19	$132.82	$25.25
Other stock sold	.40	$ 69.13	28.06	.45	$ 32.23	14.33
Total sales	.65		$73.07	.64		$39.58
Increase in stock inventory	.14		$22.14	.02		$ 7.44
Less:						
Cows bought	.06	$260.90	$15.30	.02	$169.70	$ 3.44
Other stock bought	.05	$170.72	8.80	.03	$ 88.55	$ 2.53
Net stock income	.68		$71.11	.61		$41.05

* The San Joaquin Valley herds contained a higher proportion of the heavier Holstein breed and also more registered stock sold for breeding purposes so show a higher value per head sold and a higher net stock income. The Humboldt County records were all of the lighter Jersey and Guernsey breeds. With lower selling price per head and with less raising and sale of stock, net stock incomes per cow were lower.

† n.a.—not available.

were 1.51 animal units per average cow in these herds, and a net of .68 head was raised or sold per cow.

The right-hand section of table 4 shows 33 Humboldt County manufacturing-milk records for 1949 and 1950. All of the cows were of the lighter Jersey or Guernsey breeds, so brought a lower price, as did the dropped calves. Heifers here freshened at about two years of age, so herds were well maintained with only 1.32 animal units per cow. The net head raised or sold was .61 per cow and net stock income was $41.05 per cow.

Meat-animal prices have been high in recent years. Also, there has been a strong demand for dairy stock at high prices. Hence, the high net stock incomes shown in tables 4 and 5 are probably above long-time averages. In estimating future net stock income, it would be safer to assume a figure around 10 per cent of the value of the milk sold.

EXPENSE PER COW

In determining profit in dairying, expense is as important as income. Some dairymen fail to obtain good profits because costs are higher than necessary. On the other hand, some practice false economies, such as inadequate feeding, with resulting low production and income.

In general, it is profitable to provide all the feed, labor, and facilities essential to high production, but to do it in the most economical manner possible.

A discussion of the major expenses involved in dairy farming may reveal what economies can be effected. These major expenses are feed, labor, miscellaneous costs, and overhead. Feed is the item in which skillful management will show greatest reduction of costs. It will be discussed last and at some length. Table 5 presents costs from dairy farms in three areas for 1950.

HERD SIZE IN RELATION TO COSTS

Analysis of records on dairy herds of many sizes leads to the conclusion that the most profitable herd size is that which best fits the pasture and forage production on the particular farm, whether it be 10 cows or 300. Labor and facilities can be adjusted to herd size without much cost handicap.

Ten cows in a small, sideline manufacturing-milk herd may have slightly higher overhead costs per cow, but the labor of the owner-operator, with economical, farm-produced forage can make such an enterprise profitable. Very large herds have certain advantages in low facility costs per cow and large buying power for feed and supplies, but they have disadvantages in dependence on hired labor. Once the best size of herd for a farm is determined, to keep it at that size for maximum utilization of feed, labor, and facilities is important.

LABOR COSTS

Recent dairy enterprise records show about 70 hours of labor per cow for the year in manufacturing-milk dairies, and 85 hours in market-milk dairies. This includes care of all stock in the herd in addition to milking and handling of milk. Records made ten years ago showed 50 per cent more labor required. Better equipment, smaller, more compact milking barns, and greater use of pasture, all contribute to this reduction. A saving of about 20 hours per cow by machine milking over hand milking was recorded in the early 1930's. It probably is greater today. The 1950 census showed more than 15,000 California farms with milking machines, leaving few commercial dairies without them.

The labor-requirement figures above, which are averages of several records in the San Joaquin Valley, are equally representative of other California regions where considerable pasture is used and where winters are not severe enough to require a long period of hay feeding in the barn.

Labor per cow increases slightly with increases in production per cow. It takes

Table 5: DAIRY ENTERPRISE RECORDS, THREE AREAS, 1950

	Sonoma County market milk	San Joaquin Valley		Humboldt County
		Market milk	Manufacturing milk	Manufacturing milk
Number of dairies	8	24	12	15
Average number of cows per dairy	75	63	23	39
Animal units per cow	1.32	1.51	1.56	1.31
Pounds of milk fat sold per cow	386	352	364	371
Pounds of milk sold per cow	8,327	8,849	8,939	7,524
Average price per pound of milk fat sold	$ 1.02	$ 1.00	$ .83	$ .79
Average price per hundredweight of milk	4.72	3.97	3.37	3.92
Net cost of production per hundredweight	4.15	3.18	2.94	2.89
Management income per hundredweight	$ .57	$ .79	$ .43	$ 1.03
Inputs per cow:				
Hours of labor per cow	82.7	77.4	101.7	53.8
Tons of hay per cow	3.7	4.4	5.2	2.1
Tons of concentrates per cow	1.7	1.4	1.1	.6
Tons of silage, green feed and roots per cow	.2	3.8	3.1	3.7
Animal unit months of pasture per cow	7.1	6.9	6.2	10.1
Income per cow:				
Net stock income	$ 21.47	$ 90.65	$104.24	$ 43.57
Miscellaneous income	3.59	5.52	5.07	1.21
Income from milk sold	392.56	351.09	301.31	294.75
Total income	$417.62	$447.26	$410.62	$339.53
Costs per cow:				
Hay	$ 86.33	$ 85.16	$ 97.17	$ 52.57
Concentrates	112.66	84.59	63.75	43.45
Silage, green feed, roots, etc.	.97	21.17	20.53	19.64
Pasture	31.70	40.70	35.05	45.66
Total feed cost	$231.66	$231.62	$216.50	$161.32
Hired labor	$ 47.23	$ 46.31	$ 20.67	$ 12.72
Value of operator's and family labor	29.56	28.92	76.44	41.14
Miscellaneous expenses	35.68	31.33	26.51	21.16
Depreciation of buildings and equipment	5.24	10.03	5.69	5.63
Interest on investment at 5 per cent	20.88	29.20	26.41	20.08
Total costs	$370.25	$377.41	$372.22	$262.05
Management income per cow*	$ 47.37	$ 69.85	$ 38.40	$ 77.48
Farm income per cow†	$ 97.81	$127.97	$141.25	$135.68

* Management income is total income less total costs.
† Farm income is management income plus the value of the operator's labor and interest on investment. It is the total earnings of the operator from his management, labor, and invested capital.

a little more labor to do the better feeding job and handle the additional milk, but the increase is small.

The operator who hires his dairy labor finds it an item of considerable importance. In the San Joaquin Valley the cost of hired labor and value of operator's labor was 26 per cent of the total market-milk costs, and 24 per cent of manufacturing-milk costs over the ten years, 1932–1941. In 1950, it was 20 per cent of market-milk costs and 26 per cent of manufacturing-milk costs. In Humboldt County, labor on manufacturing-milk dairies was only 54 hours per cow or 21 per cent of total costs.

Some jobs around the dairy require about the same length of time, regardless of number of cows, so labor per cow tends to decrease with increased size of herd. In larger dairies it is important to utilize fully the time of regular milkers. About 50 to 60 cows per milker is usual with good machine equipment. A herd of 75 cows might be a little too large for one milker and too small for the labor costs of two. If pasture were available, the herd might be increased to 110 to utilize fully the time of a second milker.

In the dairy business miscellaneous costs include taxes, repairs, insurance, dairy supplies, electric power, cow-testing dues, automobile expense, veterinary service, and fuel for sterilizing equipment. In recent years, these costs averaged about $20 per cow in manufacturing-milk dairies and $30 in market-milk dairies. The higher costs in market-milk dairies come with better buildings, refrigeration for cooling milk, and maintenance of better sanitation.

County taxes, largely for stock and buildings, run from $2 to $6 per cow. Electric power for lights, milking machine, refrigeration, and sometimes sterilization from $1 to $3 a cow. Oil or gas for sterilization is about $1 to $2. Cow testing by the local dairy herd improvement associations now costs $2.50 to $5 a cow a year, varying with size of herd.

This group of costs is essential and largely beyond the dairyman's control. Good care and economy can keep it at a minimum, but skimping on needed supplies, veterinary service, and cow testing is false economy.

OVERHEAD COSTS

Overhead costs of depreciation and interest are not large items. They are book or noncash costs and seldom have much effect on total costs and financial security. To have good stock and adequate facilities is an advantage, but a dairyman's financial strength can be weakened by heavy debt for nonessential facilities. The best way to hold capital outlay to the minimum is to make it carefully—to obtain the minimum essentials in the most economical manner possible.

Too much equipment or building area increases labor of maintenance. A small milking barn can accommodate many cows by several successive turn-ins. A lower investment is required for the storage and handling of hay and silage when maximum use is made of pasture.

Samples of dairy enterprise investment have been worked out on the basis of management records for a number of years. These are brought up to date with present-day costs. Investment samples for a 60-cow market-milk dairy, and a 25-cow manufacturing-milk dairy, are shown in detail in table 6. Table 7 shows a dairy enterprise investment for 1950 for both market milk and manufacturing milk.

Depreciation. In these samples, depreciation is figured on the basis of forty and thirty years for buildings and improvements, and five to twenty years for equipment. The total amounts to $14.72 per cow in the market-milk dairy and $7 per cow in the manufacturing-milk dairy.

These figures are higher than the average of actual dairy records for 1950, as shown in table 7, which are $10 per cow depreciation in the market-milk dairies, and $5.69, in the manufacturing-milk dairies. These lower, actual figures are

Table 6: SAMPLE DAIRY ENTERPRISE INVESTMENT

	60 cows—market milk			25 cows—manufacturing milk		
	Quantity or size	Total cost	Cost per cow	Quantity or size	Total cost	Cost per cow
Land in lots and corrals	2 acres	$ 800	$ 13.33	1 acre	$ 300	$ 12.00
Dairy buildings and improvements:						
Milking barn and milk house	24-cow	$ 6,000	$100.00	8-cow	$ 1,200	$ 48.00
Feed and shelter barn or shed	70 x 100	7,200	120.00	.....	600	24.00
Other buildings, calf barn, etcetera	.....	1,800	30.00	.....	600	24.00
Corral fences and gates	1,000 ft.	1,080	18.00	200 ft.	150	6.00
Paved yards and lanes	7,200 sq. ft.	2,400	40.00	.....	.....	.....
Milkers' or help cottage	.....	3,000	50.00	.....	.....	.....
Well and pressure water system	.....	960	16.00	.....	600	24.00
Total cost, buildings and improvements	.....	$22,440	$374.00	.....	$ 3,150	$126.00
Dairy equipment:						
Milking machine	4 units	$ 780	$ 13.00	2 units	$ 450	$ 18.00
Milk cooling, refrigeration, and holding tank	400 gals.	2,700	45.00	.....	80	3.20
Sterilizer	.....	210	3.50	.....	120	4.80
Miscellaneous equipment	.....	240	4.00	.....	60	2.40
Total equipment cost	.....	$ 3,930	$ 65.50	.....	$ 710	$ 28.40
Feed, average annual investment	.....	$ 2,400	$ 40.00	.....	$ 925	$ 37.00
Stock: cows at $300, bulls, calves, etcetera	84 A.U.	$21,600	$360.00	35 A.U.	$ 9,000	$360.00
Total dairy enterprise investment	.....	$51,170	$852.83		$14,085	$563.40
Feed crop land and farming equipment	90 acres	$40,000	$666.67	39 acres	$14,000	$560.00
Total farm cost except dwelling	.....	$91,170	$1,519.50	.....	$28,085	$1,123.40
Average dairy enterprise investment	.....	$37,985	$633.08	.....	$12,155	$486.20
Interest on above at 5 per cent	.....	$ 1,899	$ 31.65	.....	$ 608	$ 24.32
Depreciation, dairy buildings and equipment	.....	$ 883	$ 14.72	.....	$ 175	$ 7.00

Table 7: DAIRY ENTERPRISE INVESTMENT RECORDS, SAN JOAQUIN VALLEY, 1950

	Market milk	Manufacturing milk
Average investment per cow:		
Land in lots and corrals	$ 23.84	$ 26.74
Dairy buildings and improvements	88.27	42.08
Dairy equipment	16.46	11.44
Feed on hand	25.22	21.52
Dairy stock	430.23	426.37
Total dairy enterprise investment	$584.02	$528.15
Interest on investment at 5 per cent	$ 29.20	$ 26.41
Depreciation on dairy buildings and equipment	$ 10.03	$ 5.69

based on building and equipment costs of some years ago, which were considerably lower than today.

Interest. Dairy enterprise records include a 5 per cent charge for interest on current investment. The dairyman free of debt has no interest to pay, so may consider this 5 per cent as the earnings of his invested capital and a part of his net farm income.

For convenience, the investment for buildings and equipment used in computing interest is only half their actual cost. Their decline in value from cost to zero through depreciation, over their useful life, gives an average value over the years of about half the cost. The interest charge in the samples shown in table 6 are $31.65 per cow in the 60-cow market-milk dairy, and $24.32 per cow in the 25-cow manufacturing-milk dairy. Actual interest charges in table 7 for 1950 differ very little from the samples, as feed and stock values were higher even though facilities were lower in actual dairy records.

FEED COSTS

The next section tells how feed costs enter into expense per cow. It analyzes the relative value of dairy feeds, and suggests some good dairy management practices in feeding.

GETTING MAXIMUM RETURN FROM FEED COSTS . . .

by analyzing costs and practices

Feed cost for both purchased and farm-grown feed is from 50 to 70 per cent of the total expense per cow. This cost group offers great opportunity for false economy, sound economy, or extravagance. A study and analysis of feeding practices and costs are the dairyman's most important device in improving his profit by either: 1) reducing costs without reducing income; or 2) considerably increasing his income without greatly increasing his costs.

RELATIVE VALUE OF DAIRY FEEDS

For management purposes, it is convenient to consider feeds in four main types: pasture, hay, succulent feeds, and concentrates. All are needed and, to a certain extent, one can be substituted for another (see relative value in table 8).

Pasturage is the most economical source of nutrients for the dairy herd. The cows walk to the feed and do their own harvesting, thus saving labor and equipment costs. Since quantity weight of pasturage eaten by livestock is not known, an arbitrary unit of quantity called the *animal unit month* is used.

An animal unit month (A.U.Mo.) is the quantity of feed required by a mature head of cattle for one month. It furnishes 400 pounds of total digestible nutrients and is the equivalent of .4 ton of hay.

Hay is the main dairy feed in California and probably provides the major part of the total digestible nutrients on most of the dairy farms in California. Although nutrients cost more in this form than in pasture, considerable hay must be used since it can be stored and transported for use where and when pasturage is not available. Alfalfa hay is the main variety used, with oat and vetch hay next in importance. Even though hay varies considerably in quality, the figure of 50 per cent total digestible nutrients is satisfactory for calculating.

Succulent Feeds. Most dairymen use some succulent feed in the daily feed of the dairy cow. Tests show satisfactory results on dry feed only when such feed is well balanced and of adequate nutrient and vitamin content. So, providing succulent feed when green pasture is not available is an optional matter dependent on the dairyman's preference and the costs of the feeds he has available to his needs.

This group of succulent feeds includes silage, cut green feed or soilage, root crops, such as stock beets and carrots, pumpkins and moist by-products, such as wet beet pulp and brewers mash. Some cull vegetables and trimmings also are used as available in some areas. Digestible nutrient content of feeds in this group will vary from as low as 8 per cent to as high as 20 per cent, with 15 per cent about average.

This group is not an important source of nutrients in California; it is largely used to replace fresh green pasture when that is not available. It is bulky and so expensive to haul and store that nutrient cost is usually a little higher than for hay and considerably higher than for pasture. Where green pasturage is available most of the year, even in small amount through the winter, the use of other succulent feeds is not justified.

Table 8: RELATIVE NUTRITIVE VALUE OF FOUR TYPES OF FEED

	Hay	Grain and concentrates	Silage, green feed, roots	Pasture*
Per cent of total digestible nutrients	50	75	15	15
Pounds of total digestible nutrients in 1 unit of feed	1,000 lbs. per ton	1,500 lbs. per ton	300 lbs. per ton	400 lbs. per A.U. Mo.
Quantity of feed roughly equivalent in TDN to 1 ton of hay	1.00 ton	.67 ton	3.33 tons	2.5 A.U. Mo.
Quantity of feed roughly equivalent to 1 animal unit month of pasture	0.40 ton	0.26 ton	1.33 tons	1.0 A.U. Mo.

* The unit of pasturage is the animal unit month rather than the fresh weight which averages about 15 per cent in total digestible nutrients.

Silage is the most important and widely used succulent feed. It is made by cutting and storing such uncured green crops as corn, sweet sorghum, and oats and vetch or other hay mixtures. Its use is fairly common, particularly in areas where green pasturage of high quality is available for only a few months. Better mechanical harvesting methods in recent years have made possible wider use of silage as a means of saving and storing heavy yields of oats and vetch. Even alfalfa, which is so difficult to cure as hay in the spring, can be treated in this way. With proper methods, harvesting and storage cost only a little more than the same crop cured for hay, and nutrient content is better preserved.

Concentrates. Grains, seed meals and similar materials of high feeding value are called concentrates. Total digestible nutrient content varies from a high of 80 per cent in some grains and oil cake meals to a low of 60 per cent for some of the by-products. An average of 75 per cent is assumed to fit most mixtures or prepared mixed dairy concentrates. This group is usually the most expensive source of nutrients, but it serves two important purposes. It supplies ingredients that may be lacking in the other feeds, and it permits a sufficiently great feed intake for high-producing cows to obtain enough nutrients to reach maximum production. But since its nutrient cost is usually three times that of pasture, and twice that of hay, any feeding of concentrates beyond the quantity required materially increases feed cost.

California dairy cows are usually fed a concentrate mixture of ground grains, grain products, dried beet pulp, and oil cake meals. Some dairymen buy the ingredients and mix them. With farm-grown barley or local barley purchased at harvest time as a basic ingredient, the resulting mixture can be relatively economical. A leaflet entitled "Concentrate mixtures for dairy cows," by W. M. Regan and G. E. Gordon, is available from the office of the University of California Farm Advisor, or from the Agricultural Extension Service, University of California. Many dairymen for convenience buy prepared dairy feeds of guaranteed analysis.

Table 9, on page 26, shows comparative costs of producing some dairy feeds under nonirrigated and irrigated conditions.

GOOD DAIRY MANAGEMENT APPLIED TO FEEDING

Three Rules for Feeding

1. Know the TDN requirements of the animals for most efficient growth and production.

2. Feed a maximum of low-cost nutrients and a minimum of high-cost nutrients to provide the TDN requirements.

3. Feed concentrates according to production of each individual cow.

Total digestible nutrients (TDN) is the net digestible portion of the feed available for growth and production. TDN is the common denominator used to express the energy content of carbohydrates, proteins, and fats.

TDN REQUIREMENTS

The feed requirements of dairy animals of different ages were computed by the authors from the Morrison Feeding Standard.* The feed requirement of a cow giving 200 pounds of fat annually—that is, 13.2 pounds of TDN a day—is used as the basis for figuring the animal unit equivalents of feed for the other animals (table 10).

These feed requirements must be considered as the ideal or optimum quantities for the perfect feeding of each animal. There is considerable waste and unequal distribution of feed through variation in appetites and feeding habits in a herd of dairy cattle. It is well to furnish some additional feed, and to assume that more total digestible nutrients will be

*Morrison, F. B., Feeds and feeding. 20th ed., pp. 1004–5.

Table 9: COMPARATIVE PRODUCTION COSTS OF DAIRY FEEDS IN CALIFORNIA*

	Nonirrigated land			Valley irrigated land		
	Natural pasture	Barley for grain	Oat and vetch hay	Irrigated pasture	Alfalfa hay	Corn silage
Good crop yield, tons per acre	.....	.7	3.0	.....	6.0	15.0
Pasture, animal unit months per acre	2.0	.8	.7	12.0	1.0	.2
Total pounds of TDN per acre	800	1,412	3,280	4,800	6,400	5,480
Man labor at $1.00 per hour	$ .25	$ 5.00	$10.00	$12.00	$ 23.00	$ 28.00
Tractor work at $1.50 to $2.00 per hour	.....	8.00	13.50	1.50	15.00	18.00
Pick-up chopper and other power costs	.....	1.50	2.00	.....	3.50	7.00
Total labor cost	$ .25	$14.50	$25.50	$13.50	$ 41.50	$ 53.00
Irrigation water at $2.25 per acre foot	.....	.....	.....	$10.00	$ 9.00	$ 4.50
Seed, fertilizers and miscellaneous	.25	4.50	4.50	9.00	6.00	7.00
General expense	.05	.95	1.50	1.60	2.80	3.20
Repairs	.25	1.25	3.00	1.25	3.50	4.00
County taxes	1.00	2.00	2.00	4.00	5.00	5.00
Total cash and labor costs	$1.80	$23.20	$36.50	$39.35	$ 67.80	$ 76.70
Depreciation on equipment and facilities	$ .10	$ 4.50	$ 5.00	$ 4.00	$ 9.00	$ 12.00
Depreciation on stand	.....	.....	.....	$ 3.00	$ 7.50	.....
Interest on investment at 5 per cent:						
Improvements and equipment	$ .05	$ 1.75	$ 3.00	$ 2.00	$ 5.00	$ 6.50
Stand	.....	.....	.....	$ .75	$ .75	.....
Land	3.00	6.00	6.00	15.00	20.00	20.00
Total cost per acre	$4.95	$35.45	$50.50	$64.10	$110.05	$115.20
Net cost per ton of crop	.....	$47.80	$16.25	.....	$ 17.50	$ 7.60
Cost or value per A.U. Mo. pasture	$2.48	$ 2.50	$ 2.50	$ 5.34	$ 5.00	$ 4.00
Average cost per 100 pounds of TDN	$ .62	$ 2.51	$ 1.54	$ 1.34	$ 1.70	$ 2.10

* Calculations based on various Enterprise Management Studies and Surveys conducted by the Agricultural Extension Service.

Table 10: FEED REQUIREMENTS AND ANIMAL UNIT EQUIVALENTS PER HEAD OF DAIRY STOCK—MORRISON STANDARD*

	Average weight for period	Total digestible nutrients		Animal units per head
		Per day	Year, 365 days	
	pounds	pounds	pounds	
Calf—0 to 3 months	140	3.3	....	0.25
Calf—3 months to 1 year	310	5.3	....	0.40
Heifers—1 to 2 years	600	9.2	3,360	0.70
Heifers—2 to 2.5 years	800	10.0	3,650	0.75
Cows giving 200 pounds fat annually	1,125	13.2	4,800	1.00
Cows giving 300 pounds fat annually	1,125	15.4	5,616	1.17
Cows giving 400 pounds fat annually	1,125	17.6	6,433	1.34
Cows giving 500 pounds fat annually	1,125	19.9	7,250	1.50
Bulls—2 years and over	1,200	13.2	4,800	1.00

* In figuring over-all feed requirement for a herd for a year add 12.5 per cent, or one-eighth more, for waste.

used in the herd than are listed in the calculated standards. An excess of 13 per cent over the Morrison Standard is the quantity used as an average by San Joaquin Valley dairies. Thus the total feed requirement for a herd would be estimated by calculating requirements for the number of head of each kind, adding these to obtain herd total, and then increasing this total by 13 per cent.

RELATIONSHIP BETWEEN FEED USE AND PRODUCTION

The relationship between total digestible nutrients used per cow per year and herd average production of milk fat per cow is illustrated in figure 2. The top line may be used to estimate the probable total digestible nutrients required per cow (for the cows only) in a herd with a certain average production per cow.

Figure 2 also shows the calculated requirement from the Morrison Feeding Standard. Note that this standard is only a little below the actual use reported at the 200-pound production level, but is 15 per cent below when the 500-pound production level is reached. This may be accounted for by the more liberal feeding tendencies for high-producing herds.

HOW FEED SELECTION AFFECTS COSTS

It is profitable to use a maximum amount of lowest-cost nutrients from pasture and a minimum amount of highest-cost nutrients from concentrates. This is well illustrated by the comparison of costs in 169 dairy records from the San Joaquin Valley for 1947 to 1950, shown in table 11.

These dairies were divided into two groups within each type of dairy, according to usage of pasture. Those in the high-pasture group used more than nine animal units of pasturage per cow. Table 11 shows that in both market- and manufacturing-milk dairies the considerable saving in feed cost through the use of more pasture was largely reflected in increased profit. Differences in pounds of milk fat sold per cow are not believed to have been influenced by the extent to which pasture was used. It is significant that despite lower production per cow, the high pasture herds had greatest profit per cow.

WITH THIS CHART YOU CAN CHECK OR ESTIMATE YOUR FEED USE FOR THE YEAR

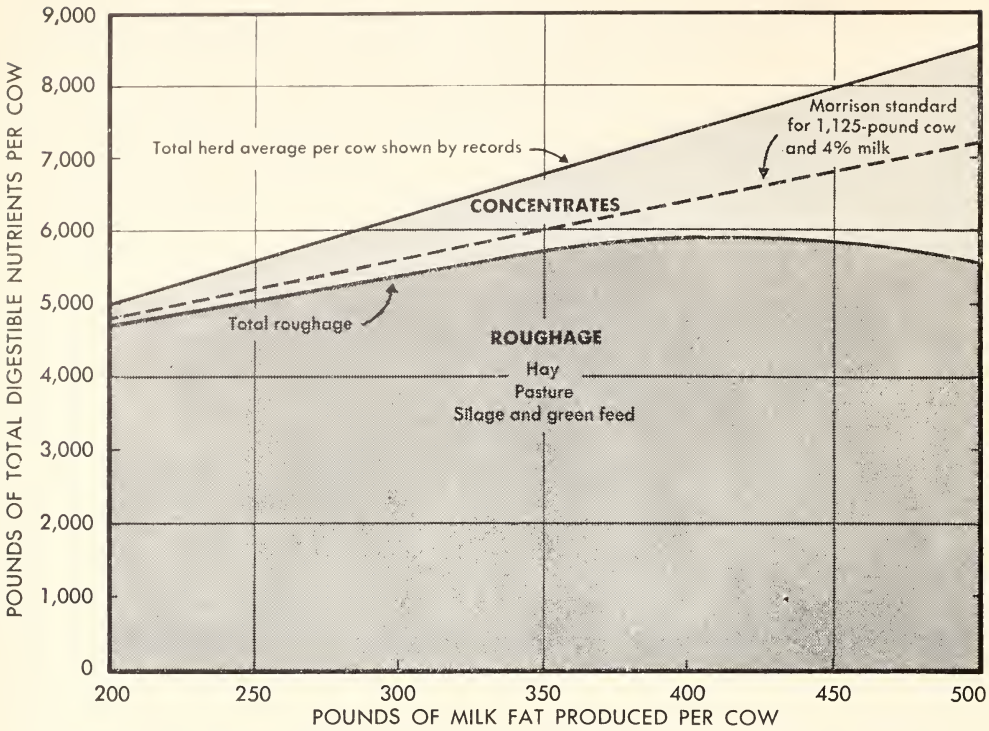

Figure 2. POUNDS OF TOTAL DIGESTIBLE NUTRIENTS USED PER COW FOR THE MILK FAT THEY PRODUCED (HERD AVERAGE) IN SAN JOAQUIN VALLEY DAIRIES

Source of data: Computed from about 550 dairy management study records in the San Joaquin Valley for 1928–1948. Feed is for the cows only, as feed for other stock was deducted from total reported. Production is that computed by dairy herd improvement association testing records which are usually 5 to 10 per cent above actual sales.

HOW TO USE THE CHART

Locate your annual herd average production per cow along the bottom line. Draw a perpendicular line to the top line marked "Total herd average per cow shown by records." Read the pounds of TDN horizontally opposite that point on the scale at left of the chart. This is the average pounds of total digestible nutrients normally used per cow for cows in herds with your average production.

You will next need to know the animal units per cow. Multiply the additional animal units in your herd by 4,800 pounds and add this to the figure for the average cow to get the total pounds of TDN per cow for your herd.

For example, a herd averaging 350 pounds of fat per cow with 1.5 animal units per cow would need about 6,800 pounds for each cow and .5 × 4,800 or 2,400 pounds for the other stock, or a total of 9,200 pounds of TDN per cow. Mulitplying by the average number of cows gives total annual feed use in the entire herd. You can estimate or convert feed values by using the figures in table 8.

Table 11: PASTURE USE, FEED COST, AND PROFIT, SAN JOAQUIN VALLEY DAIRIES, 1947–1950

	Market-milk dairies		Manufacturing-milk dairies	
	High use of pasture	Low use of pasture	High use of pasture	Low use of pasture
Number of dairies	40	66	28	35
Pounds of milk fat sold per cow	347	367	328	338
Feed used per cow per year:				
Hay (tons)	4.0	5.0	3.7	5.3
Concentrates (tons)	1.2	1.4	.8	.9
Silage, green feed, etcetera (tons)	1.6	3.3	.2	3.1
Pasture (animal unit months)	10.9	3.7	11.1	4.9
Feed cost per cow	$248.12	$269.03	$209.14	$229.27
The higher feed costs	→	$ 20.91	→	$ 20.13
Management income per cow (profit)	$ 76.10	$ 72.05	$ 44.35	$ 18.25
The higher profits	$ 4.05	←	$ 26.10	←
Feed cost per pound of milk fat	$ .71	$ .73	$ .64	$ .68
Management income per pound of fat	$ .22	$ .20	$ .14	$ .05

FEEDING CONCENTRATES ACCORDING TO PRODUCTION

The main purpose of feeding concentrates is to provide each cow with nutrients adequate in quantity and quality to maintain production at the maximum level of which she is capable. Cows producing 25 pounds of milk fat a month, or 250 a year, can obtain all the nutrients needed from roughage if given all the good hay and pasturage they will eat. But cows capable of producing more than 30 pounds of fat a month may not be able to hold sufficient bulky roughage to furnish enough nutrients to maintain high production. Therefore, it is necessary to vary concentrate feeding with the production of each cow.

Two methods of feeding concentrates according to production have been used in California. The first method, which is well established, results in rather high concentrate feeding at low production levels. This liberal feeding at low production levels does aid in building up the physical condition of cows for the next lactation period. A second method has been devised wherein no concentrates are fed at the lowest levels of production, but the increase is faster as production rises. (See table 12.) In using either method, the physical condition of each cow should be carefully observed and the quantity of concentrates adjusted accordingly.

Method 1. Divide the number of pounds of milk fat produced monthly by five. The quotient is the number of pounds of concentrate to feed daily. As production declines with advance in the lactation period, the quantity of feed declines, and usually no concentrates are given when the cow is dry. When concentrates are high in cost in relation to roughage, divide by six. If very cheap, divide by four.

Table 12: FEEDING CONCENTRATES ACCORDING TO PRODUCTION

Production per cow in pounds of milk fat			Pounds of concentrates per cow daily	
Daily	Monthly	10 months of the year	Method 1 P* / 5	Method 2 P*—25 / 2
0.8	25	250	5.0	0.0
1.0	30	300	6.0	2.5
1.2	35	350	7.0	5.0
1.3	40	400	8.0	7.5
1.5	45	450	9.0	10.0
1.7	50	500	10.0	12.5

* P = production per month in pounds of milk fat.

Method 2. Subtract 25 from the pounds of fat produced per month, and divide the remainder by two to arrive at the pounds of concentrates to feed per day. This rule puts heavy feeding where it belongs—with heavy production. It removes all concentrates from the ration of extremely low producers. It approximates actual practice as shown in figure 2.

In all concentrate feeding according to production it is frequently necessary to vary from the rule or standard followed. Young, small, first-calf heifers may need concentrates even below the 25- to 30-pound production level. When roughage quality is poor, more liberal feeding and a better concentrate mixture may be required. This general principle of feeding individual cows according to production has been well demonstrated to result in higher average production with lower concentrate use and lower feed costs.

In most herds, particularly those where concentrates are fed by hired labor, it is desirable to set a maximum quantity to be fed to any cow. This may vary with feeding practices and costs but, in most instances, not more than 12 to 14 pounds should be fed, even to a cow showing extremely high production.

SAVING IN BUYING

Wise volume buying through the most advantageous channels and at the best time of the year can result in a considerable saving. Hay purchased directly from producers at harvest time will usually be at a saving over buying from dealers at retail from month to month. Production credit may be used to finance buying in advance of use.

Current outlook for feed supplies and prices should be watched carefully for indications of when to buy. A saving of $5 a ton on concentrates and $2 a ton on hay can amount to as much as $15 a cow increased profit.

STANDARDS OF INPUTS AND COSTS . . .

inputs remain about the same; costs vary from year to year with price changes

An input is something that an operator puts into his enterprise (such as feed and labor) over which he can exert certain control of kind and quantity. Inputs remain about the same, although costs change from year to year with price changes. By using a standard of inputs it is possible to estimate current costs by applying current prices to inputs. Three such standards are given in tables 13, 14, and 15. These standards are based on the assumptions listed below. Other quantities and prices may be substituted to fit any set of conditions.

1. Raising of replacements.
2. Herd composition: total of 1.40 animal units, composed of: cows, 1; bulls, .04; calves under 3 months, .03; calves 3 months to 1 year, .10; heifers 1 to 2 years, .17; heifers over 2 years, .06.
3. Herd average production: 375 pounds of milk fat per cow with sale of 350 pounds.

4. TDN provided generously: 7,400 pounds per cow plus 2,200 for .40 animal units of other stock, or a total of 9,600 pounds of TDN per cow in market-milk herds and 9,000 in manufacturing-milk herds.

5. Prices: feed at probable future normal levels; wages at $1.00 an hour. Prices are somewhat below present prices, but above prewar. Costs may readily be refigured for current prices at any time.

FOR THE MARKET-MILK DAIRY IN THE IRRIGATED VALLEY

(See table 13)

The standard given is designed to fit the irrigated valley dairy farm with a market-milk enterprise of around 60 cows. It is assumed the herd has reached its optimum size and is being maintained by enough heifer calves raised in the enterprise. Feed costs are assumed at long-time average values but may readily be refigured at expected prices for any time and place. Since this is a market-milk standard, a little more concentrates and hay are provided and slightly less pasture than in the manufacturing-milk dairy in table 14—the purpose being to ensure level total production through the year. It would require about one acre of irrigated pasture and one-half acre of alfalfa to produce the roughage assumed. With adequate pasture for about eight months of the year, and a little occasionally during the winter, silage was not assumed to be necessary or economical.

FOR THE MANUFACTURING-MILK DAIRY IN THE IRRIGATED VALLEY

(See table 14)

The standard given is for a manufacturing-milk dairy of around 25 cows under irrigated valley conditions. The feed used per cow is a little less in total digestible nutrients than for the market-milk standard in table 13, but a little more pasture and little less hay and concentrates may be used in a manufacturing-milk dairy where it is not so important to maintain even production through the year. About 15 hours less of labor per cow are assumed to be necessary in the manufacturing-milk dairy.

In comparing net cost of production per pound of milk fat with the standard in table13, the difference in size of herd should be considered. If the above were a 60-cow herd, depreciation and interest on investment would be reduced by from ½ to 1 cent a pound of fat. Thus, under valley conditions, in comparable-sized herds of comparable efficiency, the cost of producing market milk would be about 18 cents more per pound of fat than for manufacturing milk; and that is at the prices and for the conditions assumed in these standards.

FOR THE MARKET-MILK DAIRY WITH NATURAL PASTURE

(See table 15)

The standard given was prepared to fit a market-milk dairy in the natural pasture area near the coast, as in Marin or Sonoma county. Part of the feed is provided by local or farm-produced oat and vetch hay and silage, and part is alfalfa hay purchased from off the farm, so price per ton is assumed to be higher than in the two preceding standards. Although total digestible nutrients are assumed to be the same per cow as in table 13, in this area more would come from hay, silage, and concentrates and less from pasture. Silage is included in this standard because it can be economically produced in this area without irrigation and because it is of high value in the long period when good pasture is not available. A little more labor per cow than appears in table 13 is assumed to be needed for the hand feeding of the additional hay and silage. These differences in feeding and available feeds result in a slightly higher cost per cow and in 2 cents more per pound of milk fat, but such a small difference is of little significance and may easily be offset by managerial differences or lower transportation costs to a nearby market.

Table 13: A STANDARD OF INPUTS AND COSTS FOR MARKET-MILK DAIRY ENTERPRISE, USING FARM-GROWN ALFALFA HAY AND IRRIGATED PASTURE

	Pounds TDN* per cow	Quantity per cow	Unit price	Costs (in dollars)		
				Per cow	Per hundred-weight milk	Per pound milk fat
Concentrates	1,800	2,400 lbs.	$ 3.00	$ 72.00	$ .78	$ .21
Hay	3,400	3.4 tons	20.00	68.00	.74	.21
Irrigated pasture, about 1 acre per cow	4,400	11 A.U.Mo.†	6.00	66.00	.72	.19
Total feed	9,600	.....	.....	$206.00	$2.24	$ .59
Labor		85 hours	1.00	85.00	.92	.24
Miscellaneous: cow testing, power, fuel, taxes, repairs, etcetera		.....	.....	30.00	.33	.09
Depreciation based on 60-cow dairy, table 6		.....	.....	14.00	.15	.03
Interest on dairy enterprise investment at 5 per cent, table 6		.....	.....	30.00	.33	.09
Total expense				$365.00	$3.97	$1.04
Less probable net stock and miscellaneous income				35.00	.38	.10
Net cost of milk sold per cow, 9,200 pounds; 350 pounds fat				$330.00	$3.59	$ .94

* Total digestible nutrients.
† Animal unit months.

Table 14: A STANDARD OF INPUTS AND COSTS FOR A MANUFACTURING-MILK DAIRY USING FARM-GROWN ALFALFA HAY AND IRRIGATED PASTURE

	Pounds TDN* per cow	Quantity per cow	Unit price	Costs (in dollars)		
				Per cow	Per hundred-weight milk	Per pound milk fat
Concentrates	1,500	2,000 lbs.	$ 3.00	$ 60.00	$ .65	$ .17
Hay	2,700	2.7 tons	20.00	54.00	.59	.15
Irrigated pasture, about 1 acre per cow	4,800	12 A.U.Mo.†	6.00	72.00	.78	.21
Total feed	9,000	.....	.....	$186.00	$2.02	$ .53
Labor		70 hours	1.00	70.00	.76	.20
Miscellaneous: cow testing, power, taxes, etcetera		.....	.....	20.00	.22	.06
Depreciation based on 25-cow dairy, table 6		.....	.....	7.00	.08	.02
Interest on dairy enterprise investment at 5 per cent, table 6		.....	.....	24.00	.26	.07
Total expense				$307.00	$ 3.34	$ .88
Less probable net stock and miscellaneous income				37.00	.40	.11
Net cost of milk sold per cow, 9,200 pounds; 350 pounds milk fat				$270.00	$2.94	$ .77

* Total digestible nutrients.
† Animal unit months.

Table 15: A STANDARD OF INPUTS AND COSTS FOR A MARKET-MILK DAIRY USING PURCHASED ALFALFA HAY AND FARM-GROWN OAT AND VETCH HAY AND SILAGE AND NATURAL PASTURE

	Pounds TDN* per cow	Quantity per cow	Unit price	Costs (in dollars)		
				Per cow	Per hundred-weight milk	Per pound milk fat
Concentrates	2,250	3,000 lbs.	$ 3.00	$ 90.00	$ .98	$ .26
Farm oat and vetch hay	1,570	1.6 tons	18.00	28.80	.31	.08
Purchased alfalfa	1,500	1.5 tons	23.00	34.50	.38	.10
Farm silage	1,080	3.0 tons	7.50	22.50	.24	.06
Natural pasture, about 4 acres per cow	3,200	8 A.U.Mo.†	4.00	32.00	.35	.09
Total feed	9,600	.....	.....	$207.80	$2.26	$ .59
Labor		90 hours	1.00	$ 90.00	.98	.26
Miscellaneous: cow testing, power, taxes, etcetera		.....	.....	30.00	.33	.09
Depreciation on buildings and equipment		.....	.....	14.00	.14	.03
Interest on dairy enterprise investment at 5 per cent		.....	.....	30.00	.33	.09
Total expense				$371.80	$4.04	$1.06
Less net stock and miscellaneous income				35.00	.38	.10
Net cost of milk sold per cow, 9,200 pounds; 350 pounds milk fat				$336.80	$3.66	$ .96

* Total digestible nutrients.
† Animal unit months.

PLANNING THE DAIRY FARM BUSINESS . . .

fit herd size to amount of feed produced;

fit labor supply, buildings, equipment to herd size

A well-organized dairy farm business is one where herd size is fitted to the amount of feed that can be produced most economically on the farm, and where labor supply, buildings, and equipment are fitted to size of herd. Roughage production on the farm is the most important consideration since farm-grown forage is usually cheaper than feed purchased and transported. Ordinarily it is most profitable to keep the herd adjusted to yearly use of the pasture and other feed produced on the farm, with little roughage to buy and no surplus hay to sell. Purchase of some additional hay is justified where the farm is not suited to the production of enough to supplement the pasture available, or where the farm is too small to furnish all the roughage for a herd that utilizes the available labor, buildings, and equipment.

SIZE OF FARM

Fit Labor to Size of Herd. Labor on a large dairy farm may be more easily and profitably adjusted to the farm than can dairy herd be adjusted to number of workers. On small farms, however, it might be more desirable to adjust the size of herd to utilize fully the one or two men available. The minimum-sized herd for a sideline enterprise on a general or fruit farm should be about 10 cows. Fewer cows would not require much less time nor justify a milking machine and place in which to milk.

The One-man Dairy Farm. A specialized dairy farm for the support of a single family and with one principal worker should have 20 to 40 cows. Where both pasture and hay are produced, 20 to 25 cows would keep one man fully employed and furnish a living. On such small farms, haying may present some difficulty, so a single worker may prefer to buy hay and have more pasture and more cows, in which case he can handle 30 to 40 cows. In the dry-lot dairy, where all feed is purchased and delivered, a man can handle 40 to 60 cows.

The Two-family Dairy Farm. A dairy farm justifying the full-time services of two men is more efficient and less confining. The nature of the work practically requires two workers, so that one can relieve the other in illness or for days off. With two men available for putting up hay and silage with modern forage harvesters, this size farm would require no additional seasonal labor.

The 50- to 60-cow dairy farm with 50 acres of irrigated pasture and 25 acres of alfalfa can be handled efficiently by two men. Either man should be able to do the milking while the other could do most of the irrigating and farm work. The herd is large enough to justify the best of equipment and yet small enough for the owner to know his cows and to feed and breed them individually for best results.

A dairy farm of this kind should provide a comfortable living for the two workers and their families. The two workers can be partners, a father and son, or an owner and employee. The two-family farm is suggested as the goal of all dairy farmers.

BALANCE STOCK AND FEED PRODUCTION

In planning or reorganizing a dairy farm it is necessary to know the soil and the roughage that can be produced. Alfalfa requires a deep, permeable soil and considerable irrigation. Irrigated pasture may be produced economically on shallower and denser soils, but it requires considerable water and frequent irrigation. Oats and vetch for hay or silage may be produced on a wide range of soils, and

in alternate years with summer fallow, and in regions of low rainfall without irrigation. Rolling lands not suited for crop production may be used for natural pasture. Since pasture is the most economical source of nutrients, it should receive first consideration in land use, up to the point where the maximum amount usable by the dairy herd is provided.

A list of common feed crops, showing good commercial yields in quantity and in total digestible nutrients, is given in table 16. The pasturage shown is in addition to the crop harvested, and its feeding value is included in the total digestible nutrients. The labor requirement for each crop is an estimate based on local studies and usual methods of production on a moderate scale.

MAKE A CROPPING PLAN

The next step in planning the dairy farm is to decide on the acreage of each feed crop and to estimate the expected production. Each field or area is listed with its crop, its acreage, its probable yield per acre, and its probable total production of crop and pasturage. Table 17 illustrates such a cropping plan and shows how the total feed production is compared with a feed requirement of a 60-cow herd based on the standard in table 15. This example shows a shortage of hay and a surplus of silage and natural pasture. Subsequent trials would explore the possibility of growing more hay on some of the pasture land or of increasing the herd in order to use most of the pasture and to buy more hay.

PLAN PASTURE FOR LONGER SEASON

Pasture is the cheapest of dairy feeds, and its production and feeding require the least amount of labor. But it is also the most difficult to have in the correct amount throughout the year. Careful planning and the use of several kinds of pasture can extend the season of use and provide occasional pasture in the winter.

Table 16: DAIRY FEED CROP YIELDS AND LABOR REQUIRED

Crop or land use	Harvested crop yield per acre	Pasture, animal unit months per acre	Total pounds TDN* per acre	Hours of labor required per acre	Pounds TDN* per hour of labor
Alfalfa, loose hay	6 tons	1.0	6,400	23	278
Alfalfa, cut and used fresh	20 tons	1.0	6,400	35	183
Barley for grain	1,600 lbs.	0.8	1,584	5	317
Barley for winter pasture	.....	4.0	1,600	3	530
Grain hay	1.5 tons	0.5	1,700	7	243
Oat and vetch hay	3.0 tons	0.7	3,280	10	328
Oat and vetch silage	9.0 tons	0.7	3,300	13	254
Pasture, irrigated	.....	12.0	4,800	12	400
Pasture, good natural range	.....	2.0	800	0.2	4,000
Root crops, beets, etcetera	30.0 tons	1.0	6,000	150	40
Silage, corn or sorghum	14.0 tons	0.2	5,120	28	183
Sudangrass pasture, irrigated	.....	6.0	2,400	12	200
Sudangrass pasture, nonirrigated	.....	3.0	1,200	4	300
Wild or volunteer hay	1.5 tons	1.0	1,900	6	316

* TDN—total digestible nutrients; see page 25 for definition.

Table 17: SAMPLE DAIRY FARM CROP AND FEED PRODUCTION PLAN (First Trial for Nonirrigated Farm in Coast Counties)

Field no.	Crop or land use	Acres	Yield per acre		Total feed obtainable			
			Crop (tons)	Pasture, A.U.Mo.*	Hay (tons)	Grain (tons)	Silage, etc. (tons)	Pasture, A.U.Mo.*
A	Oats and vetch hay	18	3.0	1.0	54	....	....	18
B	Oats and vetch hay	23	2.5	1.5	80	....	....	34
C	Corn silage	19	12.0	.3	....	....	228	6
D	Knoll-dry pasture	5	....	2.0	....	....	....	10
E	Natural pasture	227	....	2.0	....	....	....	454
F	Back pasture	120	....	1.0	....	....	....	120
	Total	412	....	....	134	....	228	642
	Needed for 60-cow herd				186	60	180	480
	Difference, shortage or surplus				−52	−60	48	162

* Animal unit month.

Table 18 shows the pasturage obtainable by months from several types under good conditions.

Production and months of use vary considerably from place to place and from year to year, with variations in weather and management. On any farm with considerable pasture, dry or irrigated, there will usually be a surplus in the spring and a shortage in fall and winter. Cutting a crop of hay from part of the irrigated pasture in the spring will reduce the surplus peak. Having plenty of pasture will permit an extension of its use into early winter. Alfalfa and crop fields can provide a little occasional pasture during the winter. Barley planted especially for pasture provides economical winter feed.

HOW MUCH PASTURE?

It would be ideal from the cost and the nutrition standpoint to have as much pasture as could be used by the herd every month of the year. But some reduction in winter is inevitable. Some hay will be required for bulls all through the year, and a little for the cows and other stock even when abundant pasture is available. Pasturage can probably be used, up to 13 animal unit months per average cow for the cows and young stock usually in the herd.

The last line in table 18 shows a reasonable pasture requirement totaling 13 animal unit months of pasturage per cow for the year. Good yields of irrigated pasture are about 12 animal unit months of feed per year, but yields over 20 have been obtained. Hence, where irrigated pasture is available, one acre or more should be provided per average cow. Poorer-yielding irrigated pastures would necessitate more acreage per cow.

Nonirrigated natural pasture is not only low in pasturage production but is of high quality only a small part of the year. It can furnish most of the roughage for the milking herd for a few months in the spring, although dry and young stock can get part of their feed from it during the rest of the year. The standard in table 15 has been carefully calculated to fit this type of dairy, and shows 8 animal unit months of feed as the probable maximum that can be used per cow. Near the coast, where good natural pastures produce 2 animal unit months of pasturage per acre, 4 acres would produce that much. Under less favorable conditions it might require

Table 18: ANIMAL UNIT MONTHS OF PASTURE PER ACRE BY MONTHS

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total A. U. Mo.
Irrigated permanent pasture, southern California	.6	1.0	1.5	1.7	1.8	1.4	1.4	1.2	1.3	1.4	1.1	.6	15.0
Irrigated permanent pasture, central valley	.1	.4	.8	1.2	2.0	1.8	1.6	1.3	1.2	.8	.6	.2	12.0
Barley for winter pasture	.5	.6	.7	1.0	.2	....	....	....	....	....	....	....	3.0
Barley for grain	.4	....	....	....	....	....	.4	.4	....	....	....	....	1.2
Natural range, average	....	.1	.2	.3	.3	.1	....	....	....	....	....	....	1.0
Good range near coast	.1	.2	.3	.4	.5	.3	.1	.1	....	....	....	....	2.0
Sudangrass, irrigated	....	....	....	....	....	1.0	1.5	2.0	1.0	.5	....	....	6.0
Sudangrass, nonirrigated	....	....	....	....	.5	1.0	.7	.4	.3	.1	....	....	3.0
Reasonable need per cow*	0.5	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.0	0.8	0.6	13.0

* A herd in which adequate replacements are being raised will contain from 1.35 to 1.5 animal units per cow and can use around 1.3 animal unit months of pasturage per cow each month. A reasonable standard, however, would recognize the need to do with less in the winter, therefore 13 animal unit months of pasture per cow per year is a good goal.

as many as 6 or 8 acres. A standard recommendation is 4 to 6 acres of good natural pasture per average cow for dairy farms with natural pasture. Additional pasturage on crop fields, or on a small irrigated pasture, would be desirable.

PLANNING THE YEAR-ROUND PASTURE

A pasture plan, estimating the pasturage available from each field and crop each month, is helpful in obtaining a maximum well-distributed quantity. Table 19 illustrates such a plan for an irrigated valley dairy farm with a 30-cow herd containing 1.35 animal units per cow. In Trial 1, it shows a slight shortage of pasture for most of the year, with a small surplus in May and June. In Trial 2, it puts into irrigated pasture the 8 acres used in Trial 1 for silage and barley for winter pasture. This results in nearly adequate pasture most of the year, with a considerable surplus in May and June. Cutting 20 acres of the irrigated pasture for 20 tons of hay in those months would eliminate this surplus and partially replace the winter feed lost by not growing silage. A calculation of feed costs under both trials indicates a saving for Trial 2. The harvesting of 20 tons of hay from the irrigated pasture, plus the purchase of 6 additional tons of hay, will cost less than using the 8 acres for silage and winter barley as in Trial 1. Similar calculations for other farms usually show that a shifting of land from harvested crops to irrigated pasture reduces costs.

The opportunity to increase the pasturage available from a given acreage of irrigated pasture by improving yields should not be overlooked. More fields with a shorter grazing interval and longer period for regrowth usually improve total yields. In some cases, additional fertilization or improvement in irrigation help materially. Weed control or a change in plants through some additional reseeding may also improve the quality and quantity of forage obtained.

Table 19: SAMPLE PASTURE PLAN FOR A VALLEY DAIRY FARM

	Acres	Total animal unit months of pasturage												
		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Trial 1														
Irrigated pasture	25	3	10	20	30	50	45	40	32	30	20	15	5	300
Knoll natural pasture	6	..	2	2	2	2	1	..	..	..	..	..	..	9
Alfalfa	12	3	3	..	..	..	..	..	..	..	..	6	3	15
Barley for pasture	8	4	5	6	8	..	..	..	..	..	..	..	2	25
Corn silage		..	..	..	..	..	..	..	..	..	4	..	..	4
Total	51	10	20	28	40	52	46	40	32	30	24	21	10	353
Need, 30-cow herd		15	30	39	39	39	39	39	39	39	30	24	18	390
Difference		−5	−10	−11	1	13	7	1	−7	−9	−6	−3	−8	−37
Trial 2														
Irrigated pasture	33	3	13	26	40	66	59	53	43	40	26	20	7	396
Knoll natural pasture	6	..	2	2	2	2	1	..	..	..	..	..	..	9
Alfalfa	12	3	3	..	..	..	..	..	..	..	..	6	3	15
Total	51	6	18	28	42	68	60	53	43	40	26	26	10	420
Need, 30-cow herd		15	30	39	39	39	39	39	39	39	30	24	18	390
Difference		−9	−12	−11	3	29	21	14	4	1	−4	2	−8	30

BUYING THE DAIRY FARM . . . consider such items as land values, investments needed, and the credit situation

The dairy enterprise alone, shown in the example in table 6, involved an investment of $853 per cow in a 60-cow, market-milk dairy; $563 per cow in a 25-cow, manufacturing-milk herd. Larger dairies, or those with partially depreciated facilities, or with more meager facilities, will have lower investments per cow. Those with elaborate facilities may have higher investments. Cost of land for feed production and cost of the operator's dwelling add to total farm investment.

LAND VALUES

The average value per acre of California farm land is estimated to have reached in 1946 a peak of 102 per cent above the 1935-1939 average, and to have receded to 63 per cent over the prewar level by March, 1950. But by March, 1952, it rose again to 200 per cent of the 1935-1939 level. This is merely an indication that the average value of farm land more than doubled as a result of high wartime prices of farm products, declined with the rather drastic drop of fruit prices, beginning with the 1947 crop, and then increased again with the price rises following fighting in Korea.

Declines in value of land suited to dairy farming have not been observed since 1946. Irrigated pastures on shallow land have sold for as much as $400 an acre in recent years, as compared with prewar value of around $100. Good irrigated land suited to alfalfa and a variety of other crops was, before the war, worth from $200 to $300 an acre, and is more than double that now. Whether it will stay about where it is, increase further, or decline will depend on the future trend in prices of California farm products.

POSSIBLE INVESTMENTS

A minimum-sized family dairy farm with 30 acres of land suited only to irrigated pasture could cost as follows: land, $9,000 and up; irrigation well and pumping plant, $2,000; 25-cow manufacturing dairy enterprise, $14,000 (table 6); operator's dwelling, $5,000 and up; and extras enough to bring the total to $30,000 or more. Such a farm would furnish pasture only; all hay and concentrates would be purchased.

This is about the minimum on which a modest living would be obtainable. Some of the capital required could be borrowed, but its repayment with interest from earnings would mean a reduction for a long period of years, in the amount available for living. If much purchase debt were necessary, it would be better to borrow a little more and obtain a larger place with greater earning possibilities.

A 60-cow, two-family dairy farm under irrigated valley conditions could well utilize about 60 acres of irrigated pasture and 30 acres of alfalfa. This acreage, with irrigation system, fences, and pasture stands will probably have a normal value of $400 to $500 an acre. Hence, 90 acres would have a value of around $36,000 to $45,000. Another $50,000 investment for the 60-cow market-milk enterprise (table 6), about $5,000 for tractor and farming equipment, and $8,000 for an operator's dwelling would bring the total invested capital to around $100,000. A farm of this size and investment would be a good, two-family dairy farm.

CREDIT

The dairy business is stable, and with a regular monthly cash income there is no difficulty in obtaining credit for the purchase of a good dairy farm, or additional, shorter-term credit for the purchase of cows, equipment, and even feed. But a heavy debt load is difficult to repay from earnings. Gross income must meet

operating costs and living costs and still leave enough for debt retirement.

A potential borrower will do well to estimate carefully future income and expenses and avoid more debt than can be repaid easily. There will be many additional unforeseen expenses but little chance of unexpected additional income.

A Budget Test. A sample calculation will show how much credit can be safely handled. Suppose the 25-cow, 30-acre dairy farm discussed above were under consideration. Good cows producing enough for a sale of 325 pounds of milk fat per cow annually would mean a sale of 8,125 pounds of fat in manufacturing milk. At 75 cents a pound this would bring $6,100. An additional $800 for net stock income would make a gross income of $6,900. Expenses for hay, concentrates, power, taxes, cow-testing dues, and miscellaneous items are estimated at $4,000. This leaves a net farm income of $2,900 for living and debt retirement.

A mortgage debt of $15,000, amortized over a 30-year period with interest at 4 per cent, would call for annual payments of $867. That would leave only $2,033 for living. Additional short-term credit for purchase of cows would be too difficult to repay.

Similar calculations also indicate that under any probable combination of milk prices and land values, it will be very difficult to repay from earnings more than 40 to 60 per cent of the total capital involved in a stocked and equipped dairy farm.

DEBT RETIREMENT

A calculation of probable income and costs for manufacturing-milk production, at actual prices from 1925 to 1944, shows how very difficult it would have been to repay with interest a debt of $375 per cow over that twenty-year period. That was about half the investment required in 1925.

For the first six years there was enough net income for modest living and for the annual debt payments of $30 per cow. But from 1931 through 1935 there was an average of only $11 per cow left for living expenses if debt payments were made first (only 30 cents in 1933). The small dairyman with debt was obviously in distress and in arrears in his mortgage payments.

Again from 1938 to 1940 there was scarcely enough income for both living and debt payments. Only the high prices of the war years made possible a good living and the retirement of remaining debt. This could happen again. Debt should be kept at safe, low levels and repayment should be flexible enough to permit higher payments in good years and little or no payments in bad years.

RENTING MEANS DIVIDING THE INCOME

Many California dairy farms are rented. The landlord usually furnishes land, buildings, irrigation facilities, and some nonmovable equipment. The tenant usually furnishes cows, movable equipment, and labor.

It is generally accepted that in renting, the income should be divided between landlord and tenant in proportion to their contributions or to what they furnish and the costs they pay. The landlord's contributions are largely the use of his capital invested in land and buildings. This is converted into an annual charge by figuring interest at an appropriate rate (4 or 5 per cent) on a normal valuation. Depreciation on the facilities furnished by each party may be readily estimated. The labor and management furnished by the tenant can be estimated. Other costs can be determined from past records or may be estimated from available local information. The amount contributed by each party may then be totaled to show their costs.

Table 20 presents an illustration of the possible division of contributions to a dairy farm. In this case, where hay must be purchased by the tenant, about 25 per

Table 20: SAMPLE CONTRIBUTIONS OF TENANT AND LANDLORD FOR A 36-ACRE IRRIGATED PASTURE MANUFACTURING-MILK DAIRY

	Division		Total farm business
	Tenant	Landlord	
Capital invested:			
Land, irrigation plant, etc., 36 acres at $100	.....	$14,400	$14,400
Farm buildings and fences	.....	4,000	4,000
Dwelling	.....	5,000	5,000
Equipment	$ 1,200	800	2,000
Dairy stock and miscellaneous, 34-cow herd	12,000	.....	12,000
Total investment	$13,200	$24,200	$37,400
Depreciation on facilities:			
Irrigation system and pasture stand	.....	$ 210	$ 210
Farm buildings and fences	.....	180	180
Dwelling	.....	160	160
Equipment	$ 100	60	160
Total depreciation	$ 100	$ 610	$ 710
Cash costs:			
Concentrates, 30 tons at $60	$ 1,800	.....	$ 1,800
Hay, 92 tons at $22	2,178	.....	2,178
Hired labor, 140 hours at $1	140	.....	140
Hired tractor work, 33 hours at $3	99	.....	99
Electric power, dairy and irrigation	315	.....	315
Cow testing dues	136	.....	136
Miscellaneous supplies and repairs	250	200	450
Taxes and insurance	130	295	425
Sub-total cash costs	$ 5,048	$ 495	$ 5,543
Value own labor and management	3,000	150	3,150
Depreciation from above	100	610	710
Interest on investment	660	1,210	1,870
Total all costs	$ 8,808	$ 2,465	$11,273
Less net stock income, all to tenant	1,200	.....	1,200
Net cost of milk sold	$ 7,608	$ 2,465	$10,073
Approximate per cent of total	75	25	100

The above division is based on the landlord's furnishing the farm and the tenant's furnishing the dairy herd and all direct labor on the farm and in the dairy enterprise, and each paying the costs as shown. At the costs used for illustration it would require 10,073 pounds of milk fat at $1 a pound to reimburse each party for his costs—a sale of 296 pounds per cow with a 34-cow herd. At 80 cents a pound, a more likely figure, the sale of 12,591 pounds or 370 pounds per cow would be required.

cent of the annual cost of the milk produced was met by the landlord. It would be fair for him to receive one fourth of the standard production of milk, or an annual cash rent of $2,465, which would compensate him for his costs and give him a return of 5 per cent on his investment. Each dairy farm is different, and special estimates should be made to determine the amount of rent.

FORMS OF RENT

Rent paid is usually in one of three forms: cash, share, or quantity of product.

Cash Rent. A fixed annual or monthly cash rent agreed upon in advance for the period of the lease is probably the commonest form of dairy farm rental in California. If set fairly and recognized as an average for changing price-and-production conditions over a period of years in which the tenant carries most of the risk, it is a simple, satisfactory method. It sometimes breaks down in years of low price or low production on the farm when the tenant finds it impossible to pay the rent.

This rent should be a little lower than the rental under a more flexible system, where the landlord shares in variations in production and price. An improvement would be the sliding cash rent that specifies different cash rents for different selling prices of milk or milk fat.

Share Rent. Rent as a specified share of the milk income would appear more fair than cash rent since it results in dividing the risk of price and production fluctuations. On dairies largely dependent on rainfall for farm hay and pasture production, there are wide fluctuations in feed production and in cost of hay that must be purchased. Where the farm furnishes the forage, one third of the milk is a common share rent, and this may go up to one half where the landlord furnishes the cattle and perhaps pays part of certain costs.

The drawback to a straight share rent is the fact that the landlord shares in the additional income from high production, heavier feeding, and better management without making any contribution thereto. He also suffers from poor management, underfeeding, and understocking of the farm. On the other hand, for share renting to be fair to the tenant, the landlord should share in the purchased feed costs, perhaps in the same proportion that he shares in the value of the milk produced. If the landlord in the example in table 20 paid 40 per cent of the hay and concentrate cost, it would increase his share of the inputs to 40 per cent.

Rent Based on Quantity of Product. Another but less common form of rent, prevalent in Humboldt County, is the standing rent or the value of a certain quantity of milk. The farm is rated according to its capacity for a certain number of cows, and cows are assumed to have a certain standard production. This is the rated capacity of the farm in milk fat. A certain proportion of this capacity, usually about a third, is considered the annual rent, and is paid monthly or in eleven installments at the price of the milk fat for that month.

Under this system it matters little to the landlord whether his tenant has high- or low-producing cows. If the tenant buys extra feed and has high production per cow or carries more cows, he does not have to share the extra income with the landlord. This system permits actual rent paid to vary with variations in price of product, but not with variations in production due either to management or to climatic conditions. This plan is probably the fairest and most satisfactory to both parties in a region where feed production on the farm varies little from year to year. But the rating of the farm and the determining of the quantity of milk to be paid as rent must be fair to both parties.

In the example in table 20 about 25 per cent of the milk fat would be a fair rent if the valuations and costs were accurately

estimated to reflect conditions over a period of years. The capacity of the place is 34 cows, and the feed inputs used are based on the sale of 325 pounds of milk fat per cow—a total sale of 11,050 pounds of fat a year. This could be rounded down to 10,800, of which 25 per cent is 2,700 or a monthly rent of 225 pounds of fat.

PROFIT SHARING

There are other special arrangements in which a division of income or profit from dairying is a desirable feature. Partnerships and profit-sharing agreements sometimes involve a division of gross or net income on the basis of the inputs of each party. A wage or bonus to a foreman or herdsman in terms of income or profit is sometimes given. In a few instances the milkers or barn crew have been paid 12 to 20 per cent of the milk check. Where workers are paid in this manner, they may be tempted to overfeed concentrates if they are not supervised carefully or made to pay an equivalent share of the concentrate cost.

A calculation similar to that in table 20 will be found useful in arriving at actual shares or at an agreement for the future. If a share of gross income is involved, the person receiving that share should also share in some of the costs which are involved in obtaining high production.

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